# WATER WORKS & SEWERAGE

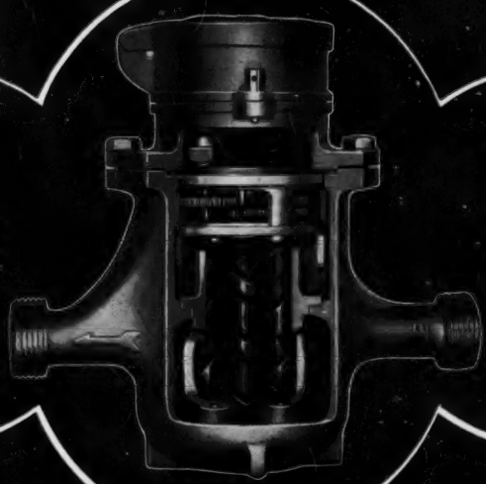
A GILLETTE ABP ABC PUBLICATION

L. H. Enslow EDITOR

SEPTEMBER 1938
VOLUME 85, No. 9

Sensational!

Noiseless
•
Positive Displacement Measurement
•
Exceptional Accuracy on Low Flows



CUTAWAY VIEW

The first practical innovation in domestic water meter design and construction to be offered the American Water Works trade in over 50 years.

IMO

Enthusiastically received, praised, tested and proven—that's been the reaction of water works men since the first announcement of the Pittsburgh IMO Meter. There is no other meter like the IMO. No other meter can even approach its performance, its accuracy on low flows, or match its straight line accuracy curve.

This unequalled performance results from the fact that the Pittsburgh IMO is the closest approach to a true positive displacement meter now made to measure water. *It is not a current or inferential type meter.* Its success is based upon the unique measuring chamber encasing three meshing and rotating hard rubber screws. Noiseless operation, without pulsation, is an important factor.

It has been determined that the Pittsburgh IMO Meter will pay for itself in a comparatively short time through measuring the trickles of water which the conventional meter will not record.

*It will pay you to get the whole story on the Pittsburgh IMO Meter. Write for Bulletin W-525.*

PITTSBURGH EQUITABLE METER COMPANY
MERCO NORDSTROM VALVE CO.
NEW YORK · BUFFALO · PHILADELPHIA
KANSAS CITY · TULSA · LOS ANGELES
*Main Offices* - PITTSBURGH, PA.
DES MOINES · CHICAGO · COLUMBIA
MEMPHIS · OAKLAND · HOUSTON

Installing U. S. Super-de Lavaud pipe for sewer force main at Cambridge, Md.

Cast iron pipe offers three advantages that put it in a class by itself as a material for pressure sewers. These are: effective resistance to corrosion; permanently tight, infiltration-proof joints; and great structural strength. These advantages are beyond question since they have been demonstrated in underground service for centuries. U. S. Cast Iron Pipe is available in sizes from 3 to 84 inches in 12-foot, 16-foot and 18-foot lengths. U. S. Super-de Lavaud *chill-free* centrifugally cast pipe is made in 3 to 24-inch sizes; U. S. Pit Cast Pipe in sizes from 3 to 84 inches. Stocks are carried at 15 shipping points throughout the nation.

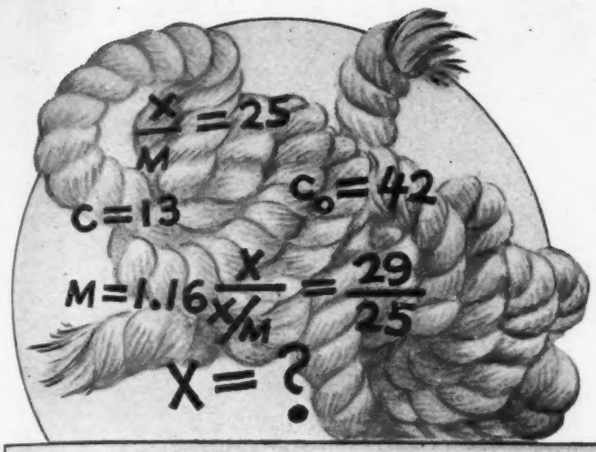
**UNITED STATES PIPE AND FOUNDRY COMPANY**

General Offices: BURLINGTON, NEW JERSEY

Foundries and Sales Offices throughout the United States

# U. S. CAST IRON PIPE

## for sewers and sewage treatment plants




# The DARCOGRAPH
## cuts the Gordian Knot
### *of complicated computation*

Removal of odor from water by means of activated carbons follows the Freundlich adsorption equation. But the water works man does not want to be inconvenienced by tedious calculations.

DARCO engineers have built all the mathematics of the adsorption equation into the DARCOGRAPH. With the aid of this extremely practical device, you can perform the computations easily and quickly. You need only follow a few simple directions.

With the DARCOGRAPH you can take advantage of the basic law of carbon performance and apply it to data obtained directly on the water you have to treat.

You can ascertain correct carbon dosage. You can select the best carbon for your needs. You can check the uniformity of successive shipments. In short, the DARCOGRAPH enables you to determine just the things you want to know about activated carbon performance.

Write today for a DARCOGRAPH set, and for a sample of Powdered HYDRODARCO. Prove for yourself the value of these DARCO developments, and the effectiveness of HYDRO-DARCO for your water.

DARCO

# DARCO
## CORPORATION
60 East 42nd Street, New York, N. Y.

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•

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# VALVES *be Seated!*

TO good-natured Charlie Elstrodt, every chlorine cylinder valve is leaky until his own "personal" test proves it is tight. Because of Charlie's hard-boiled philosophy, because of the sureness of the compressed air test, mighty few leaky valve seats have gotten by Charlie's inspection in his sixteen years at Mathieson's Niagara Falls plant.

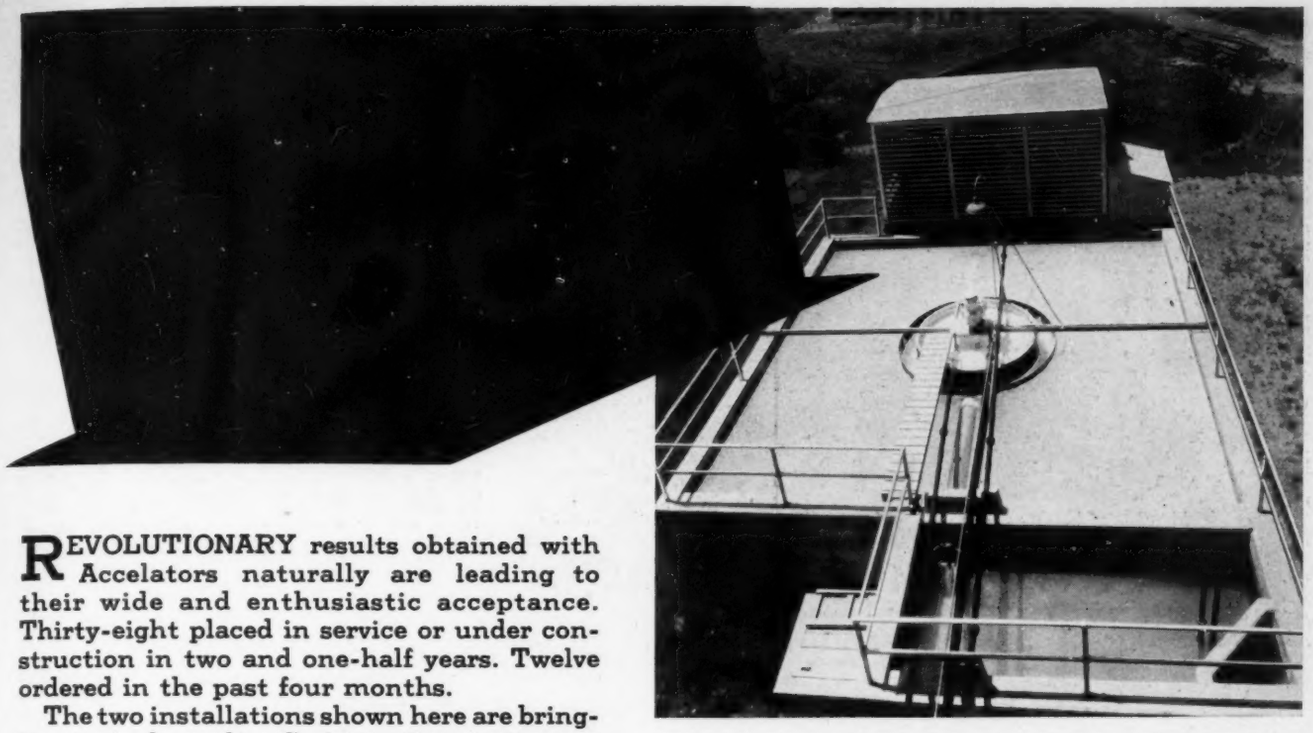
Charlie's job is one of about nineteen different steps in the cleaning, reconditioning and inspection routine through which Mathieson Chlorine cylinders and valves must pass before they are shipped. And in each of these operations it is men like Charlie Elstrodt, men who keep their eyes "glued on the ball", who give Mathieson's cylinder routine the backbone which makes it valuable to you.

Mathieson engineers produce chlorine of a purity second to none; and Mathieson workmen see that you get this pure product in clean, smooth-functioning containers. Couple with this Mathieson's unusual traffic and delivery facilities and their expert technical service and you see why this company presents a chlorine team that is hard to beat.

The MATHIESON ALKALI WORKS (Inc.)
60 East 42nd Street New York, N. Y.

*Soda Ash . . . Caustic Soda . . . Bicarbonate of Soda Liquid Chlorine . . . Bleaching Powder . . . HTH and HTH-15 . . . Ammonia, Anhydrous and Aqua PH-Plus (Fused Alkali) . . . Sulphur Chloride CCH (Industrial Hypochlorite) . . . Dry Ice (Carbon Dioxide Ice) . . . Analytical Sodium Chlorite.*

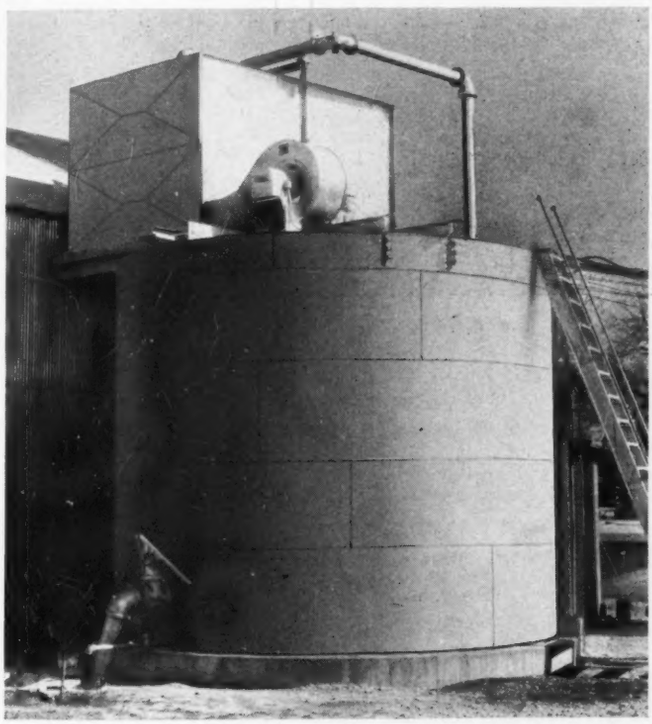
# MATHIESON CHLORINE



*Accelator Water Softener, City of Anna, Ill. Warren & Van Praag, Inc., Decatur, Ill., Consulting Engineers.*

**REVOLUTIONARY results obtained with Accelators naturally are leading to their wide and enthusiastic acceptance. Thirty-eight placed in service or under construction in two and one-half years. Twelve ordered in the past four months.**

**The two installations shown here are bringing typical results. Construction costs were cut. Operating expenses are less. Water is delivered with surprisingly lower hardness and turbidity. Reactions are more complete and performance is uniform.**



*The Accelator Water Softener at Georgetown, Texas. Joe J. Rady, Fort Worth, Texas, Consulting Engineer.*

### The Outstanding Advance in Softening

**The Accelator constitutes the most outstanding advance to date in the field of water softening. It is an entirely new development, different from any other process. While retaining all of the advantages of the well-known lime or lime-soda processes, the Accelator obtains results heretofore unobtainable—and all within time and space believed impossible.**

**Treating reagents are applied to the water in a new way, and reactions take place under new conditions. Mixing, reaction and clarification are carried out rapidly and efficiently, and in such an incredibly small space that the area of the Accelator is no larger than that of the filters.**

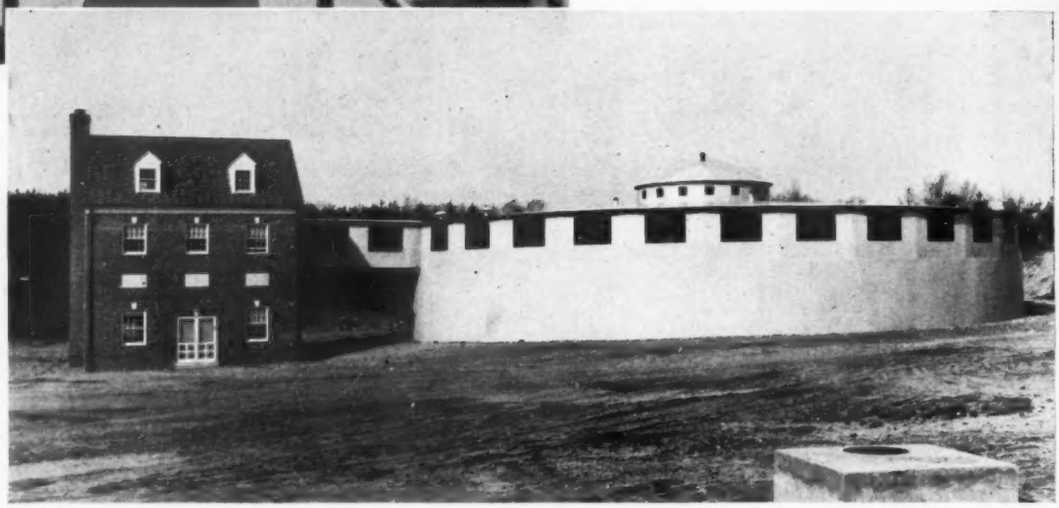
### Write for Bulletin

**Find out more about the revolutionary Accelator Softener. Write for Bulletin.**

INFILCO

# *Modern* WATER FILTRATION

## with The MORSE *ALL-STEEL* FILTER PLANT



*Pictured above is an interior view of the Morse Filter Plant, showing the operating "circle" and sight well in center. At the right is a general view of the plant, with the pump house on the left.*

**BRISTOL, CONN.** The recently completed Morse Filter Plant at Bristol, Connecticut, is attracting wide attention among water works engineers because of its unusually efficient operation, compact arrangement and modern design. These advantages are available only in a Morse plant of concentric design and welded steel construction.

Bristol obtains its water from a water shed near the town—the supply being collected in a series of reservoirs. The Morse Filter Plant is located near Reservoir No. 1. Water is pumped from this reservoir to the filter plant by means of low lift pumps. From here it flows by gravity through the filtering process into two 400,000-gallon filtered water storage tanks, and from there into the distribution system without re-pumping.

The plant has a nominal capacity of 5 m.g.d. which permits meeting present demands with about 18 hours operation daily. Two 25,000-gallon washwater tanks of welded steel construction provide water for back washing the filters.

We shall be glad to give you the complete story on the advantages and opportunities offered by the Morse *all-steel* type of construction for filter plants. Please address our nearest office.

# CHICAGO BRIDGE & IRON COMPANY

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| Chicago.....2198 Old Colony Bldg. | Birmingham.....1586 North 50th Street | Philadelphia.....1644-1700 Walnut St. Bldg. |
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| Cleveland.....2262 Rockefeller Bldg. | Houston.....2919 Main Street | San Francisco.....1083 Rialto Bldg. |
| Dallas.....1479 Liberty Bank Bldg. | Detroit.....1551 Lafayette Bldg. | Los Angeles.....1455 Wm. Fox Bldg. |

*Fabricating plants in CHICAGO, BIRMINGHAM, and GREENVILLE, PA.*

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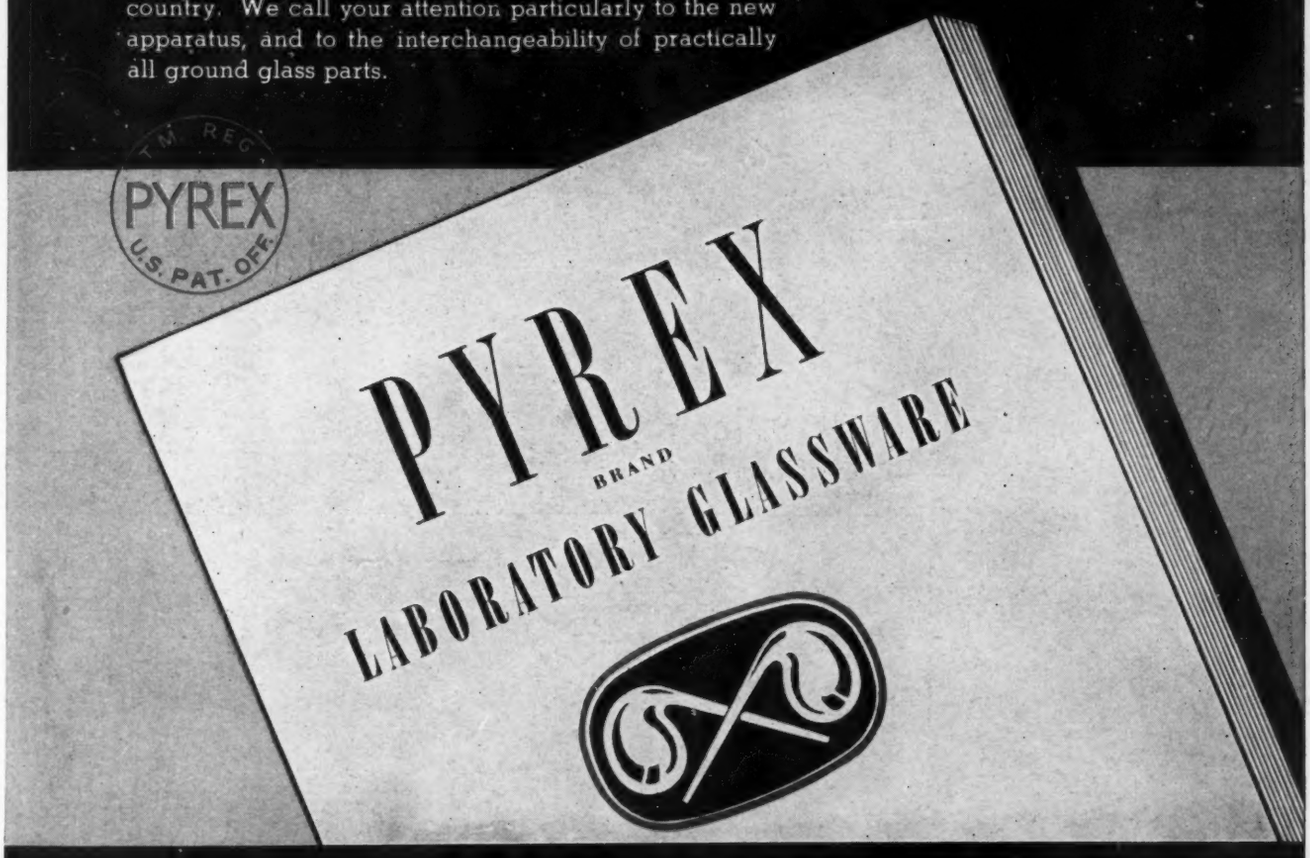
"Pyrex" Laboratory Glassware Catalog

ENLARGED—COMPLETELY REVISED

• Introduces 737 new items not listed before • Practically all ground joints, stoppers and stopcocks are now interchangeable • Prices reduced on 550 items • Discounts now apply on assortments of only 20-packages, and many items are packaged in smaller quantities.

This is, we believe, the most comprehensive general catalog of scientific glassware ever offered in this country. We call your attention particularly to the new apparatus, and to the interchangeability of practically all ground glass parts.




AVAILABLE TO SCIENTISTS, EDUCATORS, EXECUTIVES

PLEASE MAIL THIS COUPON NOW!

Please forward to me a copy of the new "PYREX" Brand Laboratory Glassware catalog LP 18.

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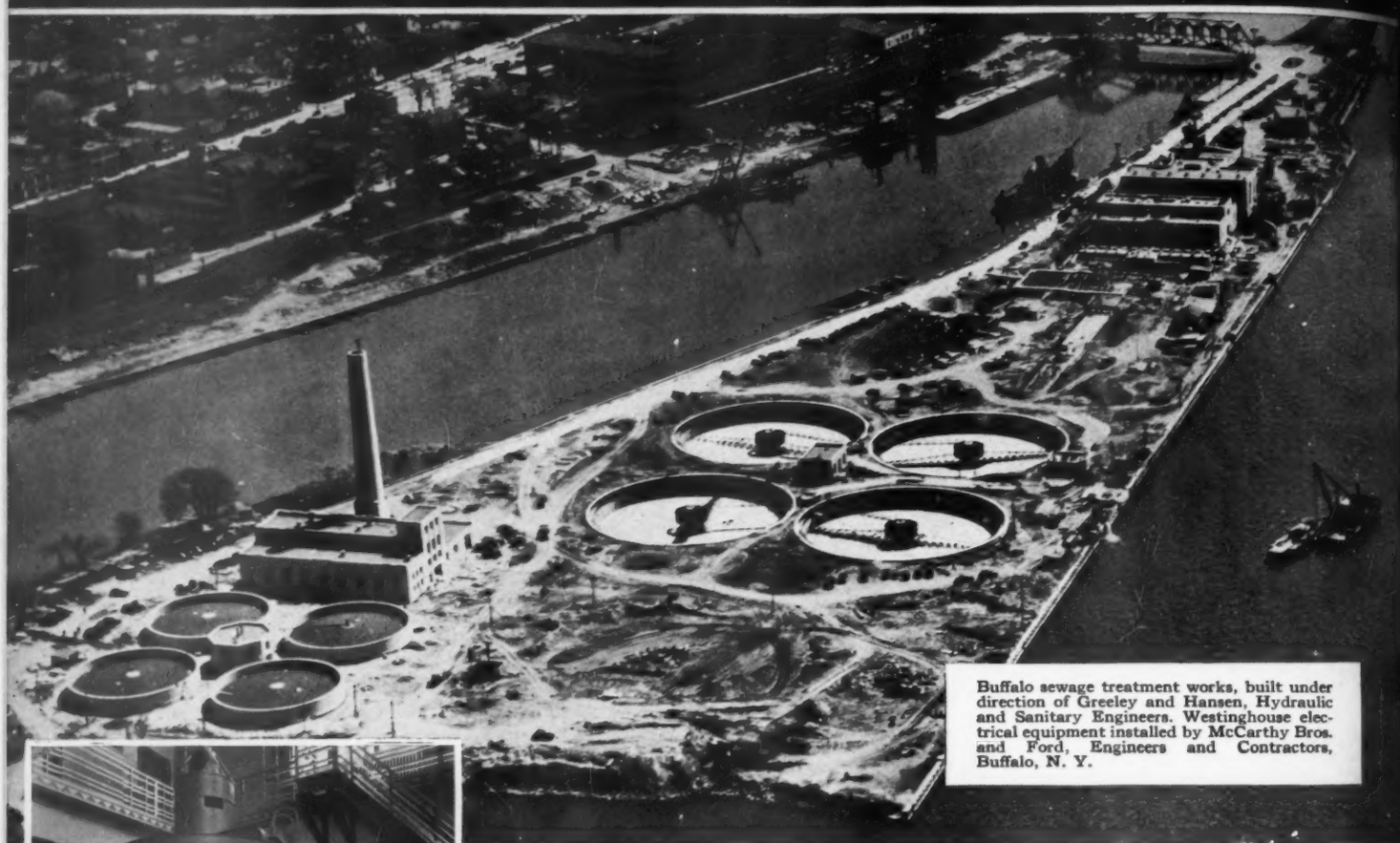
Please place my name on your regular Mailing List ☐

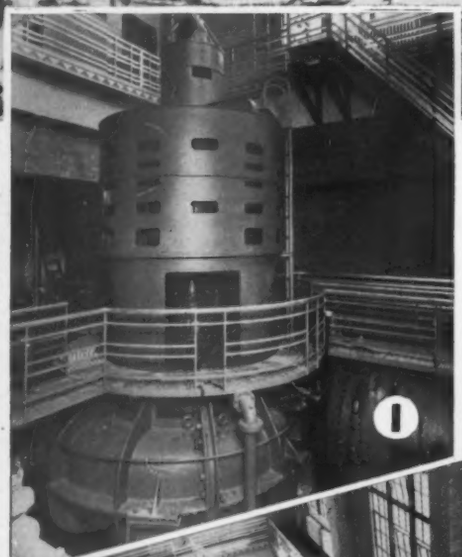
"PYREX" is a registered trade-mark and indicates manufacture by

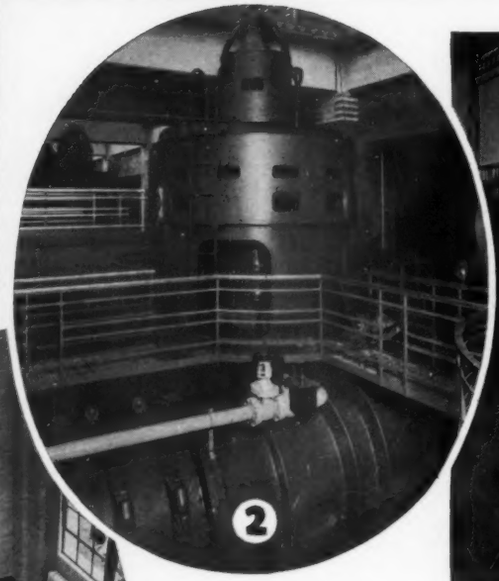
CORNING GLASS WORKS • CORNING, NEW YORK

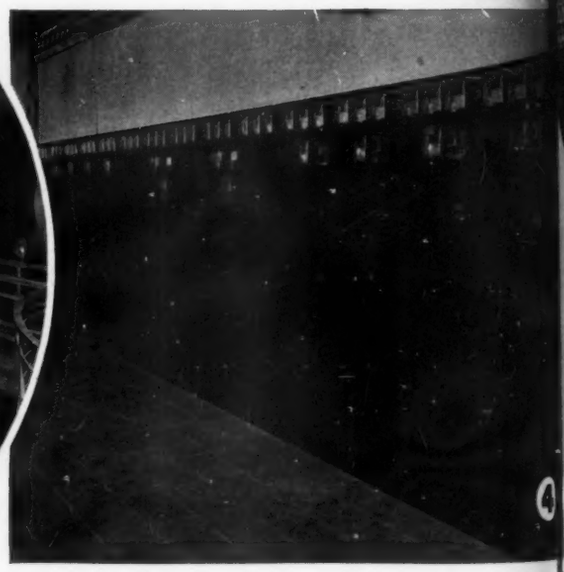
# Congratulations

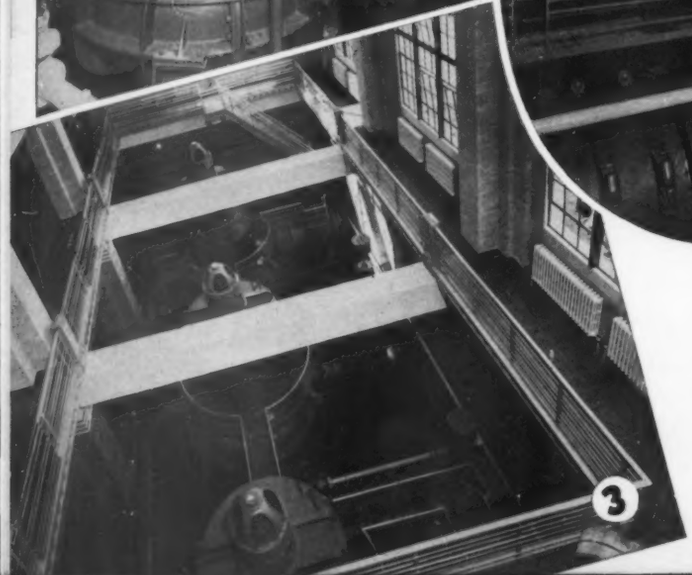


Buffalo sewage treatment works, built under direction of Greeley and Hansen, Hydraulic and Sanitary Engineers. Westinghouse electrical equipment installed by McCarthy Bros. and Ford, Engineers and Contractors, Buffalo, N. Y.









1. One of two Westinghouse vertical 2-speed synchronous motors operating 60" sewage pump, manufactured by Worthington Pump and Machinery Corporation. Motor rating — 550/375 hp., 180/157 rpm., 4160 volts. Pump rating — 120 MGD at 23 ft. TDH at 180 rpm., and 100 MGD at 18 ft. TDH at 157 rpm.

2. One of the four Westinghouse vertical synchronous motors operating Worthington sewage pumps. Motor rating — 550 hp., 180 rpm., 4160 volts. Pump rating — 120 MGD at 23 ft. TDH at 180 rpm.

3. One-half of plant, showing 2 single-speed units and 1 2-speed unit. Note supervisory control benchboards automatically governing operation of each unit, incorporating many intricate interlocking functions.

4. Westinghouse Metal-clad Switchgear, incorporating 2 incoming line units, 1 bus tie unit, 3 transformer substation feeder units, 8 primary controlling units for main sewage pumps, and 2 sections for future requirements.

# ...s from Westinghouse

# TO BUFFALO SEWER AUTHORITY!

## Completion of new sewage treatment works again marks progressiveness of "Queen City"

To many other municipal improvements of recent years, Buffalo now adds a modern sewage treatment plant, skillfully designed to meet the needs of the community for years to come.

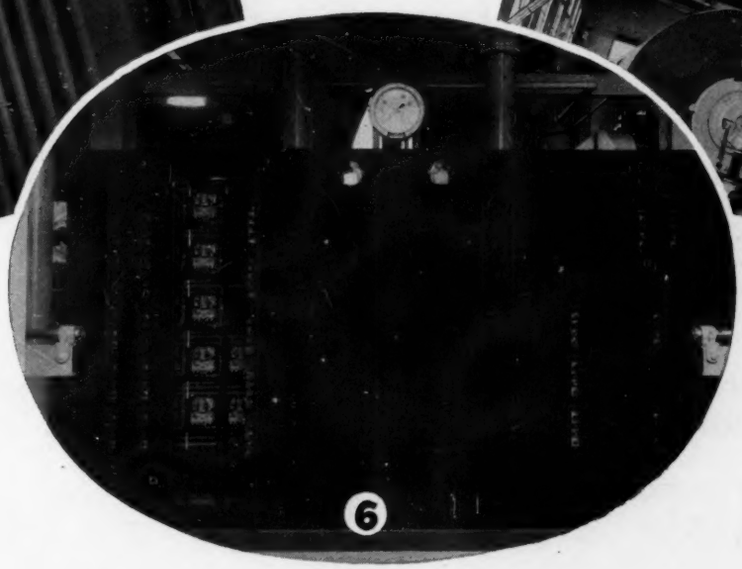
And, Buffalo is added to the 48 American cities of over 100,000 population that have Westinghouse-equipped water works or sewage disposal plants.

These cities, and their engineers, have entrusted their electrification problems to Westinghouse because of its ability to work hand-in-hand with consulting engineers . . . to apply proved Westinghouse equipment to the job. They have demonstrated that to place the entire electrification problem with one responsible organization assures smoothness in construction . . . and long-time dependability and economical performance.

Westinghouse engineers have worked with small villages as well as with large metropolitan centers. Our facilities are at your service, through local offices, or from headquarters. Westinghouse Electric & Manufacturing Company, Dept. 7-N, East Pittsburgh, Pa.

5

**5.** Westinghouse 1000 kva. substation, serving Sludge Disposal Building, Pumping Station, and Control Building. Station has three 333 kva. 4160 volt/240 volt transformers.



6

**6.** Combination power distribution and control cabinet in Sludge Disposal Building, incorporating control for dewatering equipment with "De-ion" starters. "De-ion" power distribution and lighting panels and three 15-kva. dry type lighting transformers.

7

**7.** Modern illumination provided by Westinghouse Millite Luminaire and Glassteel Diffuser lighting units in Sludge Disposal Building.

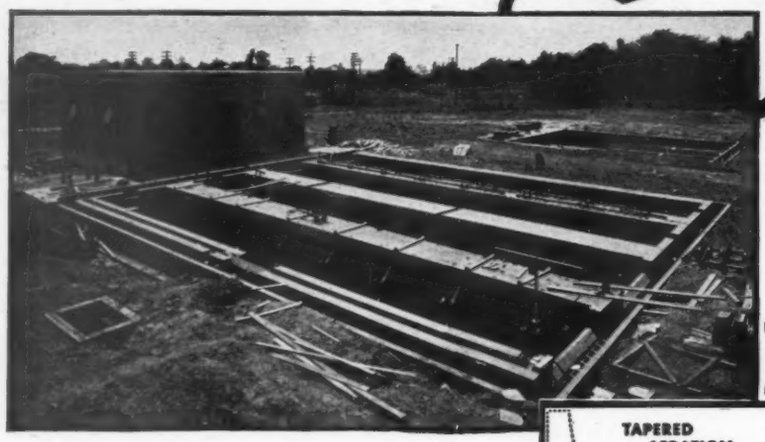
# Westinghouse

W WESTINGHOUSE ELECTRIC

ELECTRICAL PARTNER OF THE CONSTRUCTION INDUSTRY

J-938

# "CHICAGO" Swing DIFFUSERS



*Aeration tanks with "Chicago" Swing Diffusers at Lake Charles, La., sewage treatment plant. The diffuser tubes can be raised out of the tanks without interrupting operation or de-watering the tanks. Tubes can be spaced to regulate air supply.*

for

**LAKE CHARLES, LA.**
**SEWAGE TREATMENT PLANT**
*J. M. Fourmy, Consulting Engineer*
*Hammond, La.*

**Capacity for Treatment of Triple Present Flow Provided, Because of Rapid Growth of This Oil Center.**

## Flexibility of "Chicago" Swing Diffusers Makes Treatment of Triple Present Flow Possible at Low First Cost

**Service Guarantee Includes Training Operator and Checking Installation Quarterly First Year**

### *Other "Chicago" Equipment at the Lake Charles Plant*

- 2 25″ Comminutors
- 2 Scru-Peller Primary Sludge Pumps
- 4 Vertical Pedestal-Mounted Non-Clog Pumps
- 2 Horizontal Non-Clog Pumps
- 1 Sludge Division Box
- 1 Odeeometer

## CHICAGO PUMP CO. SEWAGE EQUIPMENT DIVISION

2349 Wolfram Street, CHICAGO, ILL.
Phone BRUnswick 4110

VACUUM—CONDENSATION—CIRCULATING—BILGE
FIRE — HOUSE — SEWAGE — SCRU-PELLER PUMPS
AERATORS — COMMINUTORS — SAMPLERS

REPRESENTATIVES THROUGHOUT THE UNITED STATES AND FOREIGN COUNTRIES

● EBG maintains a thorough "follow through" policy in serving customers' needs for liquid chlorine. It begins with a closely supervised delivery system and includes expert technical assistance in every type of application. You'll enjoy the friendly and willing cooperation that goes with every shipment of EBG Liquid Chlorine. It's one of the reasons why customers say, "They treat you right at EBG!"

**ELECTRO BLEACHING GAS COMPANY**

MAIN OFFICE: 60 EAST 42nd STREET, NEW YORK, N. Y. • PLANT: NIAGARA FALLS, N. Y.

EBG Liquid Chlorine
FIRST IN THE COUNTRY

# IN DOLLARS AND CENTS

## A ROYER DISINTEGRATOR *pays for itself.*

**Cities and towns from coast to coast have learned from actual experience that The Royer Disintegrator will produce enough compost suitable for Municipal Parks, lawns and gardens, the sale of which will soon pay for the cost of the machine.**

**The Royer Sludge Disintegrator will rapidly and economically shred sludge containing from 30 to 60% moisture into fine particles at a cost of 30 cents or less per cubic yard.**

**Operating and maintenance costs very low.**

***Let us send you details of the machine and interesting information on the value of disintegrated sludge as a fertilizing compost.***

**Model C-2 illustrated above—Machines made in four sizes—either belt, gasoline engine, or electric drive. Pneumatic tires standard on all models.**

***A ROYER PAYS FOR ITSELF***

## ROYER FOUNDRY & MACHINE CO.

158 Pringle St. — Kingston, Pa.

C. G. WIGLEY, Sole Rep.
3108 Atlantic Ave., Atlantic City, N. J.

# *Look to the Future*

## WHEN YOU BUY WATER WORKS VALVES TODAY

### CRANE AWWA VALVES ASSURE LONG TROUBLE-FREE SERVICE

● Your water system makes your city livable . . . brings health and comfort to your people . . . is the life-source of your industry. It's the true foundation of *your* city's future. Consider this when you buy water works equipment. Choose valves that you know will serve today's needs . . . meet tomorrow's emergencies.

Crane No. 480½ AWWA Valves are built to give that kind of performance. Crane double-disc gate valve construction is scientifically designed to provide positive action—tight and true . . . to make every part function smoothly and efficiently throughout a long life of dependable operation.

Backed by Crane's unmatched skill in valve engineering and metallurgy . . . Crane's unparalleled manufacturing experience of more than 80 years, these valves possess an inherent stamina that accounts for their uncommon behavior . . . unusual economy . . . enduring service. They're proving it daily in water systems of every size—throughout the country.

You can avoid many future problems of flow-control on the mains by installing Crane AWWA valves now. Ask your Crane representative to demonstrate their superior features—as well as other Crane-Quality equipment of *uncommon* quality—for your water works, filtration plant and sewage system.

***Be sure to see the Crane Exhibit at the New England Water Works Association Convention, Hotel Statler, Boston, Mass.***

*Crane No. 480½ AWWA Double-Disc Gate Valve with hub ends. Made in sizes of 2" to 48".*

# CRANE

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

CRANE CO., GENERAL OFFICES: 836 SOUTH MICHIGAN AVENUE, CHICAGO
NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL IMPORTANT CITIES

***IT'S WHAT'S INSIDE THAT COUNTS!***

# "Nothing to Report...except.."

36" pipe, nine miles of it, laid in 1936 and 1937 at Lynchburg, Va. Jointed with Tegul-MINERALEAD.

"Nothing to report except that the City of Lynchburg has found the material Very Satisfactory."

## . . . . . *that the Jointing of this* NINE MILES x 36 Inches of *Cast Iron Water Pipe at Lynchburg has proven* VERY SATISFACTORY!

In this business of pipe laying, often the finest report the engineer can make is "Nothing to Report". That implies: No Trouble—No Leakage—No Service Interruptions . . . and isn't that just what *you* want when you lay Bell and Spigot Water Main?

### *And here is* SOMETHING *to Report*

Many users of Tegul-MINERALEAD enthusiastically comment on its remarkable ease of handling, so the job moves along smoothly and swiftly and without need of skilled labor ● That rainy days and sudden storms call for no care to keep this compound dry, for water runs off the Tegul-MINERALEAD ingot as easily as off the proverbial duck's back . . . something to think about when the compound is stored in the open ● They also comment on the happy freedom from trouble due to change in composition—for Tegul-MINERALEAD reaches you exactly as we mix it at the plant. No amount of rough riding en route can shake down the heavier components in that 10-lb. ingot.

Tegul-MINERALEAD is a sulphur base compound. It seals practically at once, so joints meet any reasonable specification as to leakage. Streets can be restored to normal promptly—traffic hazards reduced. And joints are permanently tight and trouble-free.

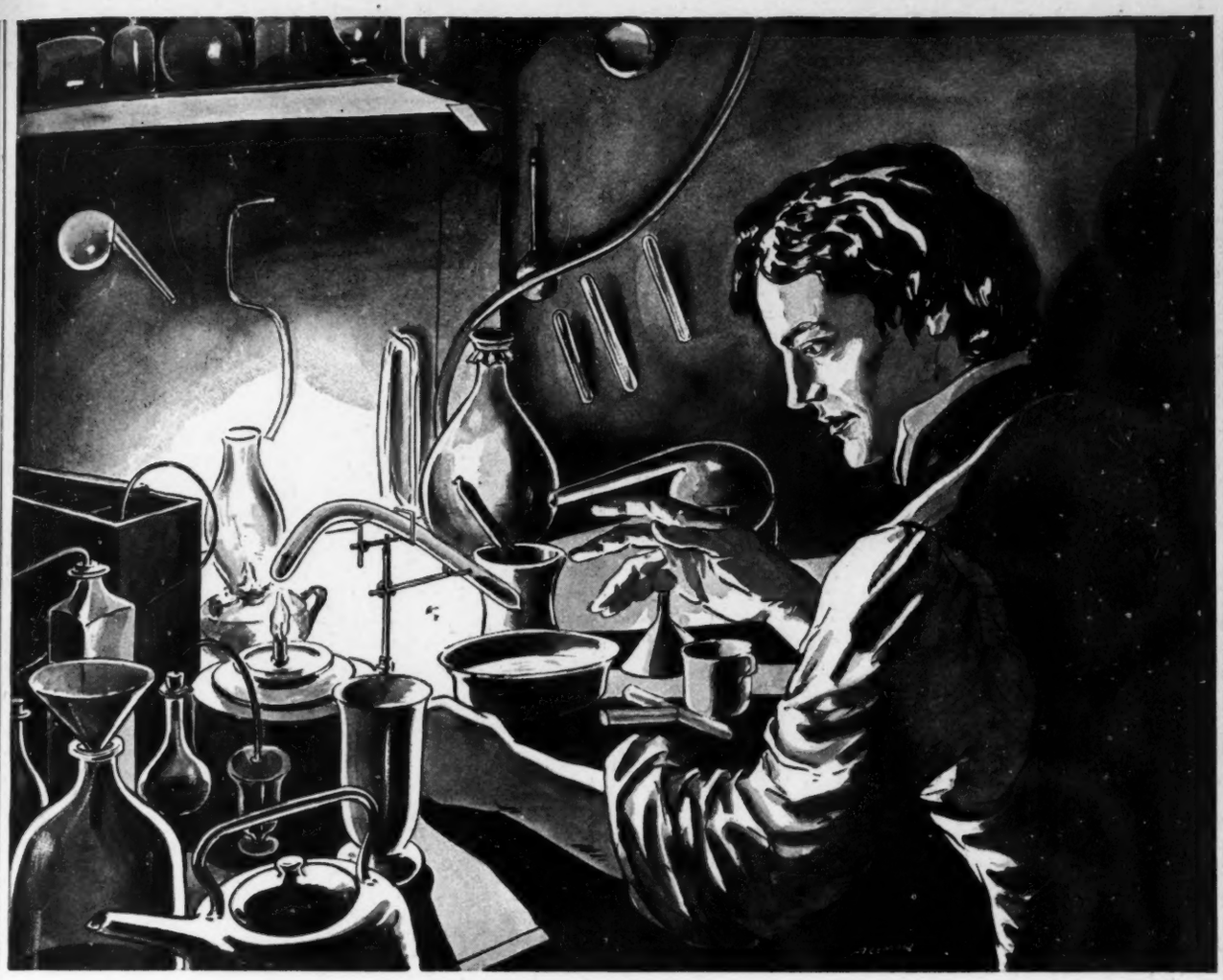
● If you want the complete satisfaction implied by "Nothing to Report" long after the job is completed and in service, write for more information.

A Tegul PRODUCT

Tegul-MINERALEAD

**The ATLAS MINERAL Products Company of Pennsylvania**

**Mertztown Pennsylvania**



It was in 1823 that the brilliant young English chemist and physicist, Michael Faraday, working at the Royal Institution under Sir H. Davy, succeeded in liquefying chlorine. In the short limb of a bent test tube he placed a compound which liberated chlorine. The tube was then hermetically sealed and the substance heated. Then by cooling the long limb of the tube a yellow liquid collected which was liquid chlorine. Strangely enough chlorine is manufactured today by the application of another of Faraday's great discoveries, in the realm of electricity. Faraday also produced several new kinds of optical glass, and all in all, his discoveries were of first magnitude in value to modern industry.

## *Through The Centuries With Alkalies*

**There may be no "style angle" to the products of this Corporation, but it has become the fashion of discriminating buyers to specify COLUMBIA. This insurance of product quality and uniformity; of prompt and intelligent service; of modern, trouble-free packaging, so vitally important in the handling of liquid chlorine, is alone responsible for COLUMBIA's commanding position in the alkali industry. In buying soda ash, caustic soda, or liquid chlorine it pays to be "label conscious". Specify COLUMBIA.**

# COLUMBIA

SODA ASH
CAUSTIC SODA
SODIUM BICARBONATE
MODIFIED SODAS
LIQUID CHLORINE
CALCIUM CHLORIDE

**THE COLUMBIA ALKALI CORPORATION**
BARBERTON • OHIO

NEW YORK
ST. LOUIS
CLEVELAND

CHICAGO
PITTSBURGH
MINNEAPOLIS

BOSTON
CINCINNATI
PHILADELPHIA

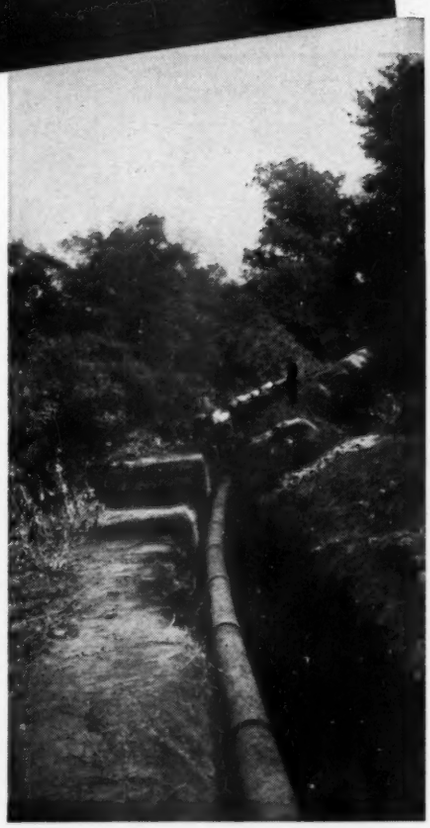
**NEW YORK.** Wet trenches do not interfere with Transite Pipe. The Simplex Coupling can be easily assembled by unskilled workmen whether the trench is wet or dry. This coupling is assembled cold . . . eliminates heat-jointing equipment.

**KANSAS.** Because of its relatively light weight and long lengths, Transite Pipe cuts installation costs. More footage may be carried per truck load to the trench and fewer men are needed for every handling operation.

# SPREADING the GOOD NEWS of TRANSITE'S MANY SAVINGS

**ARIZONA.** Because of its asbestos-cement composition, Transite Pipe is unusually resistant to corrosive soil action. This feature is particularly important when pipe must be laid in arid regions.

**TEXAS.** Transite, being non-metallic, can never tuberculate. Delivery capacity remains high indefinitely . . . pumping costs stay low . . . and costly cleaning to remove tubercules is never necessary.

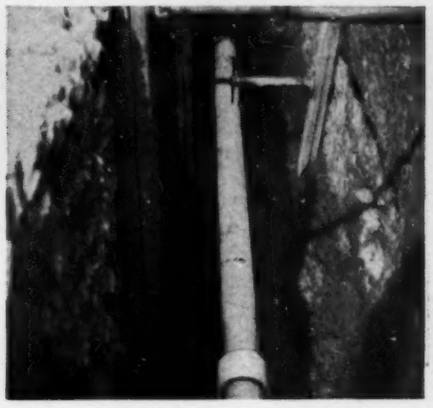


**PENNSYLVANIA.** Long sweeps can be made easily with straight lengths of Transite Pipe. The flexible Simplex Couplings permit considerable deflection . . . assure bottle-tight joints.

**CALIFORNIA.** Low installation costs . . . reduced operating expenses . . . minimum maintenance . . . all add up to a three-way cut in water-transportation costs on this Transite Pipe system.

**OHIO.** One of the many municipal water systems where Transite Pipe is used throughout. Hundreds of American cities are assured sizable reductions in water-carrying costs with this modern pipe.

**MINNESOTA.** Even in unusually deep trenches, Transite is installed quickly, easily, economically. Its great strength and flexible couplings guard against breakage due to heavy backfill.



## New installations of J-M Transite Pipe are made every day all over the U.S. . . . and every one brings lower costs . . . increased efficiency

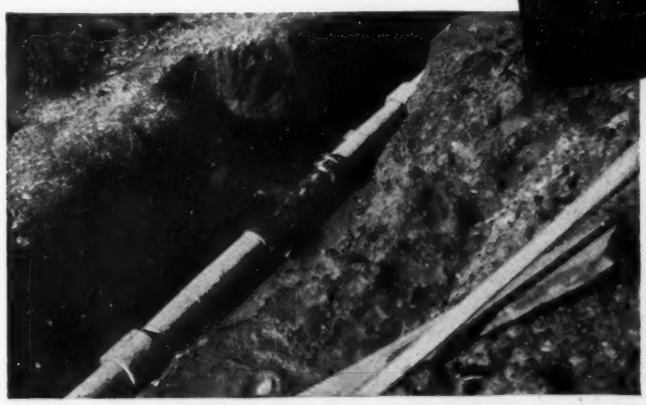
Combined in J-M Transite Pressure Pipe are all the advantages that mean efficient, low-cost water transportation. And the rapidly increasing use of this modern water carrier offers real proof of the many savings it effects . . . from installation throughout years of practically maintenance-free service.

Operating costs are reduced, because Transite's initial high carrying capacity (C=140) can never be lowered by tuberculation. That means permanently low pumping costs . . . with no shutdowns for expensive cleaning to remove tubercules. These savings alone are enough to make large reductions in water-carrying costs.

And Transite Pipe saves on maintenance charges, too. Being asbestos-cement in composition, therefore non-metallic, it is immune to electrolysis . . . and highly resistant to all forms of soil corrosion. Bottle-tight Simplex Couplings prevent leakage and the resulting breakage of pipe caused by the undermining of supporting soil.

Long life and economical service aren't all, however. Savings start at installation. For Transite is unusually light and strong . . . easy to transport and handle. On the job, its long lengths can be rapidly assembled by unskilled labor. Simplex Couplings further speed up installation . . . eliminate the need for heating equipment in the trench. Added all together, these features provide sizable savings at every step of the work.

A thorough check-up on these and many other advantages of J-M Transite Pressure Pipe will show you more ways to save. Get the whole story by writing for the Transite Pressure Pipe brochure, to Johns-Manville, 22 East 40th St., N.Y.C.



**ARKANSAS.** Connections to fittings are easily made in Transite lines. Service connections, too, are cut into the line quickly and easily with standard tapping tools and methods. Connections may be made while the main is under pressure.

**MASSACHUSETTS.** Simplex Couplings assure permanently bottle-tight joints. Consisting of a Transite Sleeve and two rubber rings, they are quickly, easily assembled . . . caulking and large bell holes are eliminated.

# LEADITE

Trade Mark Registered U.S. Pat. Office

**Leadite is the *pioneer* self-caulking material for Cast Iron Bell and Spigot Water Mains . . . but, its performance on the job, proven thousands of times during more than 35 years, makes it the accepted Standard of water works men nearly everywhere. Leadite melts freely, pours easily and makes a good tight joint . . . furthermore, tests have shown that Leadite joints improve with age. Leadite effects very considerable savings. Pick the winner . . . specify Leadite.**

**THE LEADITE COMPANY**
**Girard Trust Company Bldg., Philadelphia, Pa.**

**No Caulking**

# WATER WORKS & SEWERAGE

E. S. GILLETTE, Publisher — L. H. ENSLOW, Editor


## ARTICLES AND AUTHORS Scheduled for Future Issues

**"Filter Intestines"** is the unusual caption of a paper by H. G. TURNER, Research Engineer of the Anthracite Institute. Wishing to get the low-down on the "Why" of the present day filter, Mr. Turner puts forward some very pertinent questions for the water works engineer and chemist to answer—or, at least to think over. His comments on the "expected" of a rapid sand filter and its seeming shortcomings, as they appear to the "inquisitive novice in filter lore," have some points which can not be ignored if the truth must out. In essence, believing that present day filters and their shortcomings are being protected by a "Grandfather Clause," Mr. Turner suggests that it is time to do something about filtration specifications and filtration standards, now clearly outmoded as present day practice and observations render obvious.

**"A Study of Sewage Chlorination"** looking toward effective control with maximum economy in plant design and chlorine consumption was conducted by the Buffalo, N. Y., Sewer Authority in connection with the design of its new treatment works, and what will be America's largest sewage chlorinating station. What DR. GEO. E. SYMONS, Chief Chemist, and his co-workers learned constitutes information of basic value in future design and operation of sewage chlorination plants. The forthcoming article answers such questions as the effect of contact time; what happens in the stream after chlorinated effluents are diluted; the relative value and costs of crude sewage chlorination (prechlorination) vs. post chlorination of settled sewage. In short—why prechlorination is being adopted at Buffalo and the anticipated results therefrom.

**"Exchanging Ideas"** is the caption of a "Kink" article by ROLAND J. LEVEQUE, Supt. of Filtration, at Fredericksburg, Va. Besides much underlying philosophy of a live-wire operator, presenting experiences, the author contributes several of those always interesting and helpful operating and maintenance "Kinks." Suggesting that others may find something in the motto "Give, that ye may receive," Mr. Leveque captions his contribution "Exchanging Ideas." To our readers, we wish to say that we will be happy to assist in seeing that Mr. Leveque, and others, benefit by reading in future issues of this magazine their reciprocating "Exchange of Ideas."

**"Sewer Flow"** is discussed by JOHN D. WATSON, British Consulting Engineer, who has been contributing an interesting and valuable series of articles on sewer design and maintenance, based on long experience and observations. In his forthcoming paper Mr. Watson presents a simplified procedure of calculating sewage flow and sewer capacities. Tables of constants and factors, found useful and time saving in making such computations, constitute a valuable feature of Mr. Watson's contribution.

**"Should Water Works and Sewerage Be Managed and Operated Jointly?"**—Will be discussed by THOS. L. AMISS, Superintendent of Water Works and Sewerage, Shreveport, La. Mr. Amiss, having first hand experience, is well qualified to present arguments pro and con on this question.

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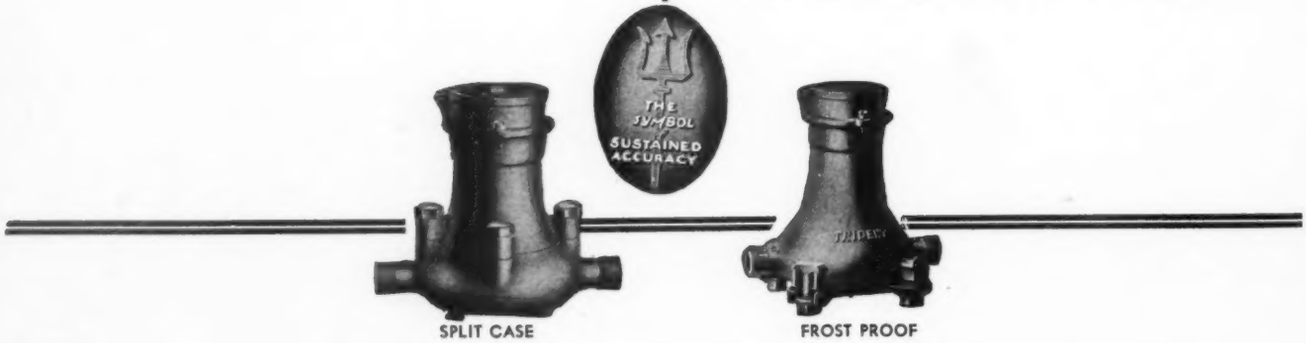
# Compare THESE STANDARDS OF ACCURACY

The American and New England Water Works Associations' Standard Specifications for 5/8" cold water meters allow a range of 4% in accuracy within "normal test flow limits," these test flows being from a minimum of one gallon to a maximum of twenty gallons a minute. The "minimum test flow" of 1/4 gallon a minute demands an accuracy of 90% or better.

The Neptune Meter Company's Standard Specifications for the 5/8" standard Trident Meters allow a range of 2.2% in accuracy within "normal test flow limits," these test flows being from a minimum of one gallon to a maximum of twenty gallons a minute. The test flow of 1/4 gallon a minute demands an accuracy of 95% or better. The "minimum test flow" of 1/8 gallon a minute demands an accuracy of 90% or better.




## One result of the precision manufacture of Trident water meters

NEPTUNE METER CO., 50 W. 50th ST. (Rockefeller Center), NEW YORK CITY
NEPTUNE METERS, LTD., 345 SORAUREN AVENUE, TORONTO, CANADA

*Water Works and Sewerage—September, 1938*

WATER WORKS AND SEWERAGE
A GILLETTE PUBLICATION
VOL 85. SEPTEMBER, 1938 No. 9

# PUTTING THE WATER WORKS G-MAN TO WORK

By ROGER W. ESTY
*Superintendent, Danvers Water Works, Danvers, Mass.*

*The Author.*

ONE OF the perplexing problems to handle in a water works plant is the customer who comes in and kicks about the large meter bill that he has just received. Of course he argues that it was impossible for him to use that amount of water. The meter must be wrong. He requests that it be taken out and another put into its place.

We try to place ourselves in his position and just imagine for a few moments that we have received a bill that perhaps amounts to $9.00. Naturally, if we had been receiving a bill for from $3.00 to $5.00 each month and then this big one came in, we would be upset. Whether he is right or wrong, when he approaches the window to register his protest, he argues in a disagreeable tone of voice to the poor girl behind the counter.

In the olden days after a lot of arguing by both parties, pro and con, the customer left in a huff vowing his vengeance on the poor water works girl or official. Today, when we receive the same kind of customer we agree with him that the bill is high, in fact all out of proportion to what he has been accustomed to paying. Then we compare with him previous readings of his meter during a similar period, and question him carefully and as diplomatically as we can. If, then, we do not determine satisfactorily, to the customer as well as ourselves, the cause or reason for the bill, we then call in the "G-Man" of the Water Department.

### What Is This G-Man?

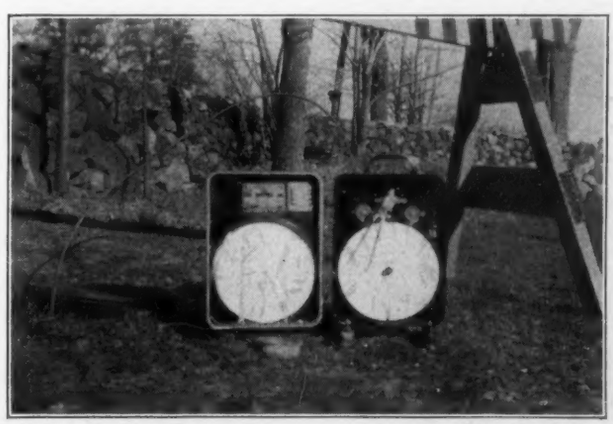
What, or who, is this "G-Man"? Well, this is a nickname given to a machine that really ferrets out and records what is going on at the house of complaining customers. Its real name is "The Meter Master." It is a device which perhaps is about three years old, and is the result of the conception and ingenuity of a real New England water works man, Frank S. Brainard, of the Water Bureau, of Hartford, Connecticut.

While there have been devices that have done this work in a similar manner, it remained for Mr. Brainard to perfect an instrument that registers on a chart the total consumption and the numerous times the water is used during a given period. It is so flexible that it can be connected to any type or style of consumer meter without disturbing the recording device of the meter.

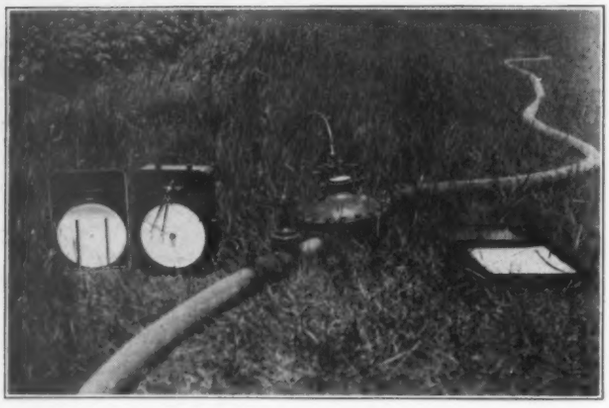
This recorder is operated by a clock mechanism which can be so regulated, that one revolution of the chart is made in 6 hours or in 24 hours. The charts are arranged with an inner and outer circle so that either the reading of a single dial meter (like an ordinary house meter) or two readings may be registered simultaneously, such as is required for a compound meter.

The accompanying picture shows the registering device and the cables that extend to and connect to the register of the meter. It can be used on either a single or a compound meter. Although the charts can be run to secure records for six hours or twenty-four hours, for general purposes it is far more desirable to use the twenty-four hour chart. Only in cases of extremely large flows, or in district testing, is it more satisfactory to use a six-hour chart.

If the meter is the ordinary house type then the first index hand would register 1 cu. ft. As the meter register hand makes one complete revolution (indicating that 1 cu. ft. of water has been drawn) the arm of the recorder makes a stroke up and down on the chart. The first index hand can also be set to register 10 cu. ft. when making one complete movement up and down. This, however, has to be done on a round reading reg-



*The "G-Man" Connected to Meter in a Pit. In Case of Rain Covered with a Dog House.*



*The Meter Master and Meter Hook-Up in 24-Hour Testing for Consumption and Leakage on a Section of Main.*

ister. It can not be thus used on a straight reading register. The complete record of rates of use, as well as total consumption, is shown when the chart makes a complete revolution in the period selected—6 or 24 hours.

In making tests, the meter cover or cap is removed and a cap ("cartridge," so called) is placed over the first index hand of the meter register. Then a holder, fastened by cap screws, is placed on top of the meter. This holds in place the flexible cable which connects the recording instrument of the "Meter-Master" to the meter. If a compound meter is to be tested, then two cables are utilized, one to each register.

## Some Experiences

In order that those who are not familiar with the machine, and its value to the water works superintendent, may get a better conception of its usefulness, I will cite several instances where it has revealed conditions on a service that the ordinary inspection and meter test would not pick up. Then the reader of this article will, perhaps, be more familiar with the advantages that this machine has over any other means of detection work that we have knowledge of.

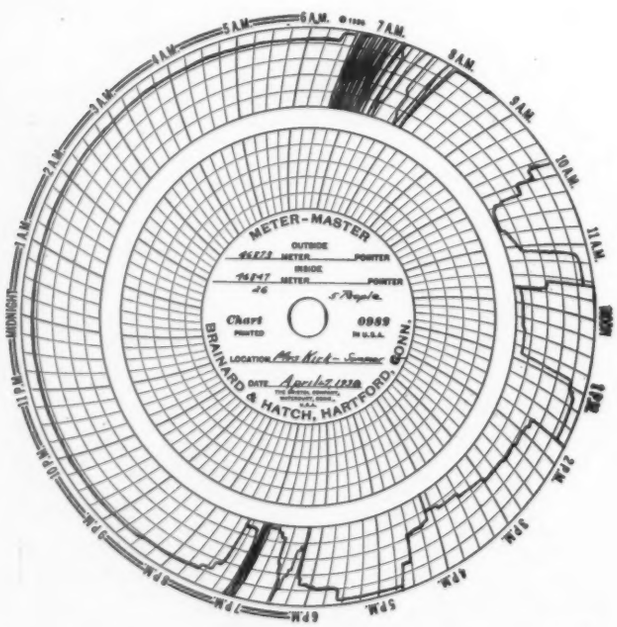



*Fig. 1. An Interesting Chart. It tracked down water waste at 6:40 A. M. (13 cu. ft.) and again at 6:55 P. M.—Trouble: a toilet tank that would keep running at times unless the handle was flipped. In another case the same thing happened four times. In another, this leakage was at a slower rate and would run undetected from bed-time to morning. To the consumer "seeing is believing."*

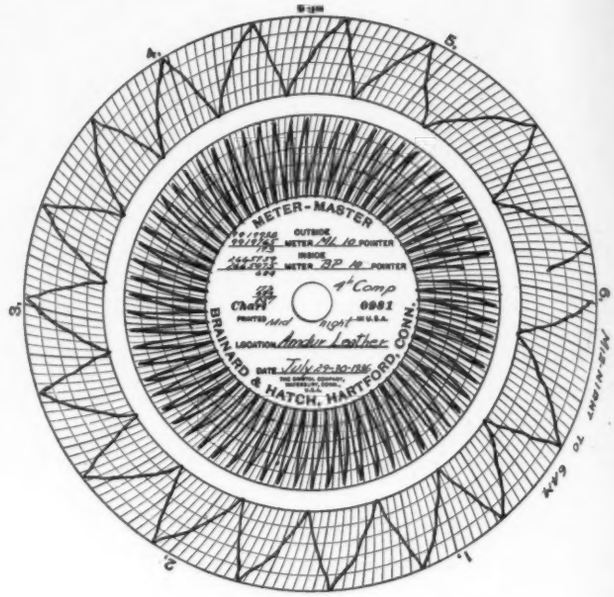



*Fig. 2. A Splendid Six-Hour Chart. A 4-inch compound meter working at an industrial plant from midnight to 6:00 A. M. This shows how important it is to have good meters and registering 100% —857 cu. ft. recorded, = avg. of 18 g.p.m.*

*First, a Simple Case.* The customer complains about the size of his bill. He says it is impossible to use so much water, and he says that there are no leaks. We go to his place. He has five overnight camps. We inspect them and find a toilet leaking in the first camp. He says it doesn't amount to anything. We connect the Meter Master to the meter and run a twenty-four-hour test. Total registration 20 cu. ft., 16 cu. ft. of this proving to be leakage. This (at 20c per 100 cu. ft.) amounts to $2.88 for the three months. Results? The customer admits his error, is pleased with the recorded chart, and thanks us with a smile for conducting the test.

*Another Case.* Two houses on one meter. Owner and wife in front house. Young couple and three old people over 70 in second house. Bill about $9.00 per quarter. We found by the chart reading that water was being used some time during 23 of the 24 hours. All during the night toilet flushings were indicated on the chart. We assumed, and since have been convinced, that this night consumption was caused by these old people. No more complaints from this customer. He had a true picture of just what is going on at his house all of the time.

*Third Case.* Two houses on one meter. Two families in front house and one in the rear. Bill about $12.00 per quarter. We found that on five different occasions four cubic feet of water was used. This amounts to 30 gallons. We questioned each family as to their habits and found that the family in the second house were the cause. Their hot water storage tank, back of the kitchen stove, got so hot it would rumble. The lady of the house would open the hot water faucet and let it run off, until it became cool, and then shut it off. This would cool it down for several hours. The cause? They had two small copper coils around the two oil burners in the stove. They were around the top of the burners and, consequently, received all of the heat. I suggested lowering the coils half way down on the burner. It has eliminated the high meter bill. This wouldn't have been

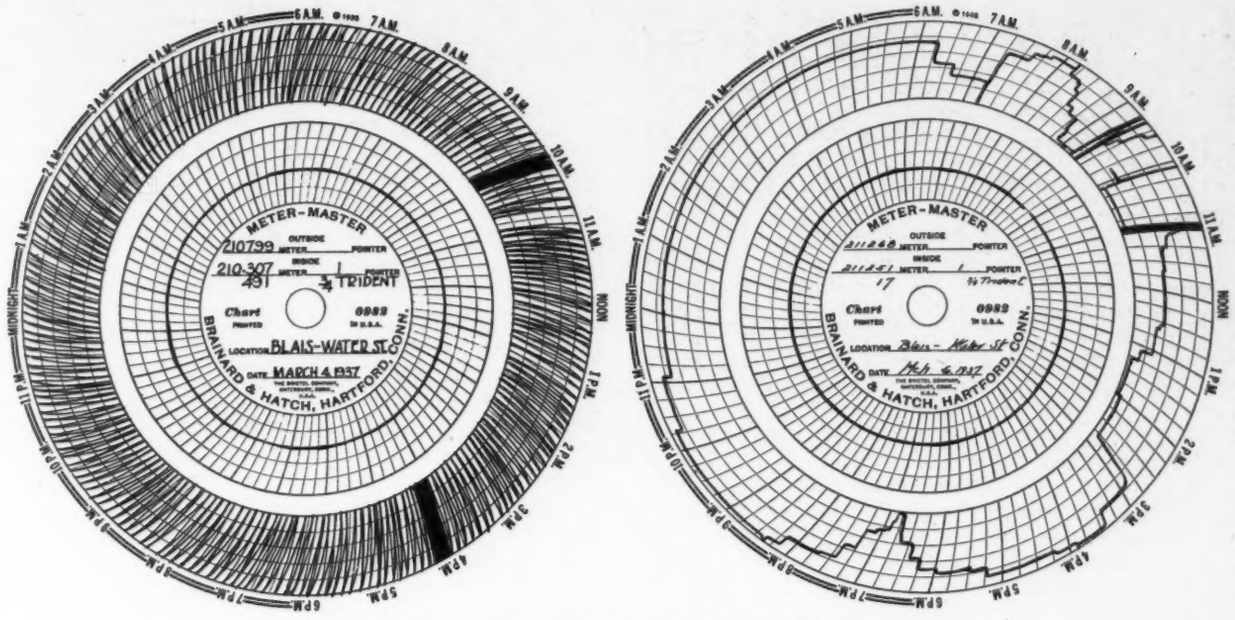



*Fig. 3. Specimens of Before and After Charts.*

*Here a ¾-In. Meter Was on a 2-In. Line about 1,200 Feet Long. A Pin Hole Leak Developed and in 24 Hours the Meter Registered 491 Cu. Ft., or 2.9 Gallons Per Minute. After the Leak Was Repaired, According to the Check Chart, the Consumer Used Only 17 Cu. Ft. in 24 Hours. Quite a Convincing Story to This Customer, and Also Quite a Saving to Him.*

*On the chart made before repair the actual number of swings of the recording pen was approximately twice the number shown here, the chart having been redrawn in this manner for the sake of clearer reproduction.*

discovered in any ordinary fixture inspection and, possibly, by no amount of questioning.

*Fourth Case.* A two-family house, and a bill of $12.00 per quarter. From the meter charts we found that on occasions, from one hour to as long as three hours, a continuous stream was running. We ran this test for three days, as it was so unusual. An inspection on one of these occasions immediately located the cause. A family of two adults and three children occupied the second floor of this tenement. The lady of the house placed her washing in a set-tub and then turned on the faucet and left the water running while she did the house work. In ten or fifteen minutes she would come back, work the garments around in the water and go off about her work again. This was kept up until the washing was completed.

## Applications Are Several

The value of this testing and recording device is twofold: First, to run flow tests on services to find out how often and at what rate the water is drawn. This, in order to determine whether the meter is too large or too small for that particular service. We have also operated at the same time a pressure recording gauge and this will record the drop in pressure when the water is drawn. Secondly, to check large or out of the ordinary meter bills. In this case it provides visual evidence of exactly how much water is used and when, and thus gives the customer an actual picture of his consumption demands. In addition, it furnishes information regarding the presence of leaking fixtures, the use of improper amounts of water by toilets and other possible sources of waste.

The rate recorder has been used in conjunction with flow tests on large meter installations to determine when heavy demand occurs and at what rate the water is drawn. It has a particular value in connection with night flow testing of the distribution system. In these tests the town is divided into districts and supplied through fire hose and in most instances through one 2-inch meter. The test is generally started at 6:00 p. m. and continued through the night to 6:00 a. m. Valuable flow data can thus be obatined economically, and without much effort.

Our source of supply is in the Town of Middleton,

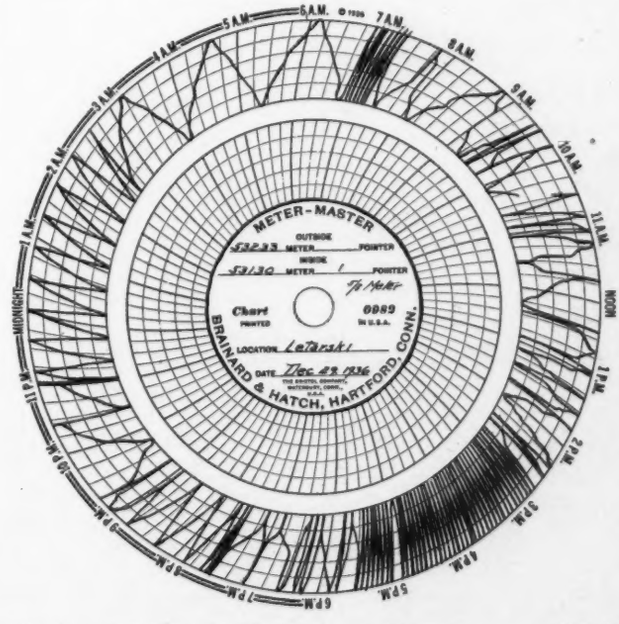



*Fig. 4. A Genuine "G-Man" Chart. This was on a two-family house. Between the hours of three and five the lady upstairs was doing her washing in running water. (See text.) The bill was running $13.90 on an average, but since discontinuing this practice it is now $5.20 per quarter. Some expensive washing.*

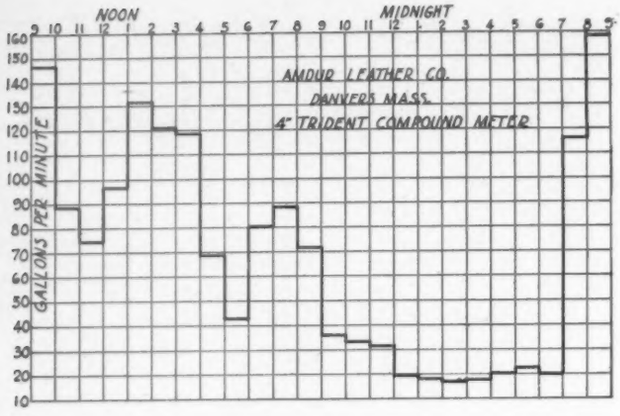



*Fig. 5. Hourly Consumption Graph. Plotted from 6-hour meter master charts, on a compound meter, covering two full days of recording, but shown here as the average for a single day. The minimum and maximum draft rates are especially useful in determining the proper type of meter to employ, etc.*

five miles from the center of Danvers. Most of this town has public water service. It is very interesting to study the daily demands of this little town. We serve a population of about 1,200 people in Middleton, through 300 active services on 7 miles of pipe. All services are metered.

The maximum demand, according to the chart, is between the hours of nine and ten in the morning, when they used 52 gallons per minute. The minimum demands come between the hours of three and four in the afternoon, when they used at the rate of 12 gallons per minute. The figures are very conclusive that the system as well as the household fixtures are tight.

The latter is another instance of the use to which this machine can be put. This test only took one day to run, but we changed charts every 6 hours in order to study more closely the variations in the demand for water for an entire town. It only goes to show how little water a small residential town actually requires.

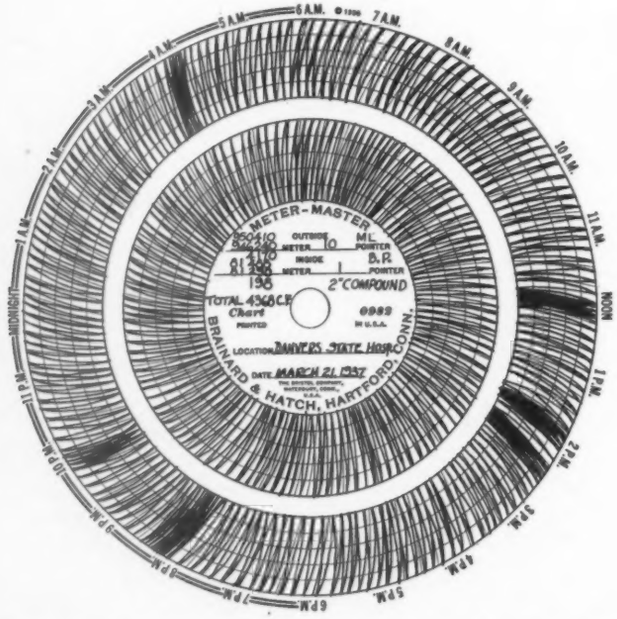



*Fig. 6. Revealing a Steady Flow Through a 2-Inch Compound Meter. This chart changed our mind as to the type of meter that should be on this service.*

*The actual number of swings of the recording pen was approximately twice the number shown here, the chart having been redrawn in this manner for the sake of clearer reproduction.*

In expressing my personal sentiments about the value that this machine has to the water works man, if I may be permitted to express myself in slang, I should say that "it is the slickest thing that has ever come down the pike" to help the water works manager learn just what's going on on his system, and to convince dissatisfied customers that the Water Department is no longer in the guessing business.

▼

## "CONCRETE PIPE IN AMERICAN SEWERAGE PRACTICE"

*A Review*

Prepared and edited by M. W. Loving, Secretary of the American Concrete Pipe Association, *"Concrete Pipe in American Sewerage Practice,"* is a handsomely bound, effectively illustrated book (6x9 in.) containing 175 pages.

The information gathered by the producer, an engineer of long experience in sewerage practices, supplies a context of information having great value to designing and operating sewerage and drainage engineers. The compiler has drawn information and experiences from every worthy source at his command. These include the leading published sewerage texts; magazine articles, by authorities of standing; and the vast experience of an engineer in contact with concrete pipe production, its installation, and sewer maintenance practice. A number of actual installations are briefly described, with recommendations and examples covering construction of concrete pipe sewers in open cut, in tunnel, or by the jacking through method. Also typical subaqueous sewers, force mains and inverted syphons are covered by informative descriptions and useful suggestions.

History states that concrete sewer pipes were first used in 1842—96 years ago—in Mohawk, N. Y. In sewer construction, Milwaukee, Wis., is credited with being a continuous user of concrete pipe for 50 years. Many pages are devoted to general considerations and computations necessary in the design of sanitary sewers, storm sewers, or combined sewers. Incorporated are several helpful data-tables and graphs. A treatise on maintenance practice follows, with reproduction in part of the most practical published articles on this important phase of sewerage practice. Following picturized descriptions of representative sewer construction projects, the draining of air-ports is covered in a chapter. "Standard Specifications" of the A.S.T.M. are appended.

In truth a "Hand-Book of 1938" on concrete pipe in sewerage practice, it should be in every designing and maintenance engineer's library. We understand that it has been produced for free (limited) distribution to engineering firms, city engineers and heads of sewerage departments who request it.

▼

## EBERLING MADE SUPERINTENDENT OF WATER WORKS AT CINCINNATI

Carl A. Eberling, on September 1st, was appointed superintendent of water works for Cincinnati, by City Manager C. O. Sherrill. He had been serving as acting superintendent since the resignation of Albert S. Hibbs on August 1st.

Mr. Eberling has been connected with the Cincinnati Water Department for 29 years. He started as draftsman and rose to become senior assistant engineer in 1928, and in 1930 was made engineer and assistant superintendent in charge of distribution.

# MAINE WATER WORKS MEN GO EAST

## *Hear About Retirement Annuities and Automatic Valves; Eat Fundy Lobster and Drink Lubec Atmosphere*

*The Light on Quoddy.*

"EAST is East and West is West"—but nowhere in these United States could East be any "easter" than at Lubec, which is on Quoddy Head at the southeastern tip of "Vacationland." (Fact is Lubec just missed being in the Atlantic time zone, but a few miles out in the Bay of Fundy. Also, little realized by many, the southeastern tip of Maine is actually north of Halifax, Nova Scotia. So, how do these Yankees get that way—talking about going "down East," when heading for "The Land of the Spud and Lobster."—Ed.)

In any event 117 members and guests travelled "Down East" to attend the Summer Meeting of the Maine Water Utilities Association, held August 10th in delightful and picturesque Lubec on Quoddy. This, much to the amazement of envious and more important Eastport, across the inlet.

### To Quoddy Light

On this perfect Maine day did they gather on the lawn of centrally located First Christian Church (also on the highest point in town) and then proceed in a caravan of cars to Uncle Sam's famed and important light house and radio beacon station on Quoddy Point, where a year ago a fog of "pea soup" dimensions made it necessary to keep Quoddy's fog-horn blasting without let-up for 10 days and nights. Here those assembled heard the tales of a grizzled master light house tender, saw the radio beacon and light operating equipment—some of it, interestingly, bearing the name plate of Wallace & Tiernan Co., who now seem to make equipment used in saving lives of those who may be on the top of, as well as on the outside of water.

*The President, David E. Moulton, Atty., Portland Water District.*

*The Secretary, Earle A. Tarr, Supt., Winthrop Water District.*

### And, to Dinner—

From this interesting experience some made a brief stop at "Pike's Puddle," along the side of the road, en route to the Water Works. Some said it was lemonade, others called it a Tom Collins. At the city owned water plant, situated in a beauty spot on a spacious lawn, at one end of which is the well-house and at the other end the pumping station, was served a mid-day lobster dinner for which Maine is duly famous. For most it was too much, and even lobster went begging.

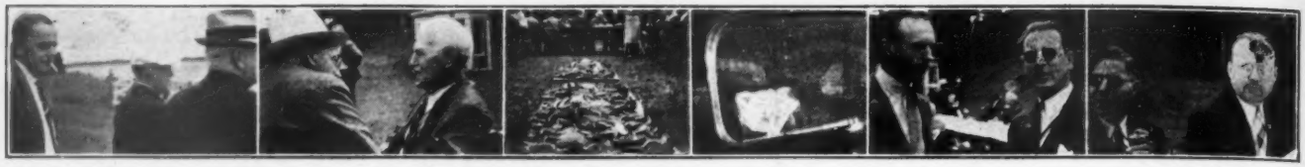
Then came the competition as to which member (guests being excluded) had travelled farthest to the Lubec meeting—and, thereby, the winner of the free dinner thus awarded at each meeting. Many thought that Ex-Senator Geo. C. Boulter, Chairman of the Water Commission of Kittery, would be the winner. However, a check up of maps showed that "the Senator" had traveled but 287 miles, whereas J. H. Woodward, Water Works Supt. of Fryberg, had come 310 miles and thereby became the winner by 23 miles. Well, that's quite a jaunt (620 miles going and coming) to attend a one-day meeting of water works men. But, that's indicative of the interest taken by members of Maine's 12-year-old Water Utilities Association, in its activities. Another interesting fact concerning this association is that it has a "dictator" in the person of its jovial president—"Dave" E. Moulton, Attorney (in fact) for the Portland Water District, who has been annually re-elected for the past 12 years. To see "Prexie" run the meeting is to understand why.

### A Show in the Wood

A pleasing surprise was the "after dinner" pageant which was staged on the terrace beyond the lawn and in the forest fringe of balsam, spruce and hemlock to make a perfect setting. In pantomime, to the strains of distant "music in the wood," by a string orchestra, was produced episodes from "Rip Van Winkle" and "Snow White and the Seven Dwarfs." Then came the "Indian Love Call" well acted and sung by local artists, against a difficult breeze. All of this was produced especially for this meeting, but appeared to have been well rehearsed. It was a capping treat to the splendid weather and a repast which seemed to make of the technical session, to follow, an anti-climax. Well it was a Summer Meeting and the technical session should have been a secondary consideration.

*The Editor, Sidney S. Anthony, Superintendent, Augusta Water District.*

*The Principle Speaker, Wm. F. End, Engr., Ross Valve Co., Troy, N. Y.*



(1) *Fergusson (Boston), Sully (Boston), Cook (Auburn);* (2) *Bangor's Read is "telling it" to a friend, whose name the camera refused to tell;* (3) *Lobster aplenty decorates the green sward;* (4) *The insignia of the Catamounts appeared on Kennebec Valley windshields;* (5) *Tom Ray, Chief Engr., New England Div. of the N. E. Water & Elec. Corp. (Skowhegan) and "Reg" Hayes (Boston) who sells "Hydrotite";* (6) *Behind another pair of blinders is "Herb" Crowell, representing Rensselaer Valve Co. in New England, and "Al" Lash of Geo. A. Caldwell Co.*

*A. A. Laflin, Supt. St. Stephen's Water Co., New Brunswick; H. J. Cook, Supt. Water Distr., Auburn, Me.; J. E. Hale, Engr., State Dept. Health, Augusta, Me.*

*F. J. Reny, Genl. Mgr. & Treas., Portland Water District.*

*J. W. Mitchell, Mgr., Lubec Water and Light Dept.*

*"Catamounts of the Valley of the Imperial Kennebec"—(All of the klan have titles, the treasurer being the Pole-Cat, what happens in "The Den" is nobody's business.)*

## Technical Session

While the ladies faded away to go sight-seeing (others wanted to do likewise) many conscientious operators and managers sat in crystal brilliant sunshine to hear papers presented.

**"The Water Supply System of Lubec"** was described briefly by Supt. J. W. Mitchell. It was completed in 1902, the source then being a spring. Since 1931 a well, of concrete caisson construction, 24.5 ft. deep and 10 ft. in diameter has supplied Lubec with a yield twice the demand. Through 20 ft. of its cool crystal-clear water the visitor can see the white pebbles on its bottom. The water is essentially non corrosive. Although apparently there has been no trace of pollution, the supply is mildly chlorinated, for absolute protection of consumers. An interesting incident was that which followed the complete metering of the system in 1917. Said Supt. Mitchell, "The outraged consumers soon caused the abandonment of the scheme." But because of flagrant and growing wastage of water, complete metering had been returned to in 1935 and had not yet suffered the fate of the earlier attempt. The Water Department and Light Department are operated jointly in Lubec, and income from the sale of hydropower makes the water works income seem like small change.

Commented President Moulton, "It's strange that most folks are willing to pay lots more to be lighted than watered—but it's a fact."

**"Automatic Control Valves,"** by WM. F. END, Ross Valve Co., Troy, N. Y.

Mr. End, considering his predicament, did a splendid job of briefly describing the design and functioning of various automatically operating and remote controlled valves, and citing application examples of the more important valves of this classification. He had come fortified with lantern-slides, from which to talk in describing the valves, but hardly could these be used in the brilliant sunlight and he had to be content with the facilities of a loud speaker and some imagination of the audience.

Pointing out that it might be surprising to many; but, on the whole, valves of the automatic type serve more importantly on small systems than on the larger ones fortified with more extensive service units and pumping facilities, Mr. End described air (intake or release) flow, pressure, and water level control valves and cited typical

**To the Summer Meeting Ladies Are Invited**

(1) *"Catamountesses"—otherwise wives and wives-to-be of Maine's "Catamounts of the Kennebec";* (2) *ladies' table at the dinner;* (3) *on with the show in the wood;* (4) *which the President finds highly interesting;* (5) *Jas. M. Caird, pioneering supervisor of water treatment, and Mrs. Caird, of Troy, N. Y.;* (6) *some of the fair sect at Quoddy.*

*(1) One-half of Walter Arnold (Public Wks. Supply Co., Lynn, Mass.) and Arthur Burke (Augusta) who represents E. & F. King Co. of Boston; (2) R. F. Etheridge, Pres. and Mgr. Etheridge Fdy. Co. of Portland, Theo. Laskey, Supt. Pump Sta., Lubec, and A. W. Read, Supt. Water Dept., Bangor, Me.; (3) Fred. Gibbs of W. & T. Co., and Howard Potter, Engr. Public Utilities Comm., Augusta; (4) C. J. Marson, Mgr. Eastport Water Co., and Alex Cameron, Mgr. Penobscot Water Co., Orono, Me.; (5) Geo. H. Winegar, Treas., and E. R. Garver, Supt. Oakland Water Co., Oakland, Me.; (6) "Exporter and Importer"—(only such known)—A. A. Laflin, exports water from St. Stephens, New Brunswick across the border, to "Importer" R. E. Manson, Mgr. Calais (Me.) Water & Power Co. During prohibition nothing but water came through—says they!*

applications of each. Also he described automatic check and shut off valves for preventing water loss from reservoirs or tanks in case of main failures. Amongst the most important, and recently improved valves, were the pressure relief valves to minimize water hammer from line surges. Descriptions of some of the more intricate combination pressure reducing valves, with fire flow by-pass features, proved too much to follow without drawings, but it sounded as though the present day automatic valve equation is next to infallible. The Ross combination valve which insures a full or nearly full tank, while maintaining a set minimum pressure on the far reaches of the system, was particularly interesting. One particular valve (we dub it "King of the Automatics") seemed capable of 7 automatic operations, cited by Mr. End. (Note.—The writer has used the terms Ross valves in his report, although the name was not so used by the speaker. We state this because Mr. End was commended on the complete absence of company advertising in his very enlightening presentation. —Ed.)

**"Report of Committee on Annuities"**—Presenting his first report, as a progress report on the study of Annuities for Retired Municipal Water Works Employees, F. J. Reny, Gen'l. Mgr. and Treasurer, Portland Water District, presented the results of his investigations as to the potentialities, the feasibility and costs, of operating a fund to provide life, disability and retirement insurance, on a group basis through sound insurance companies. This, in comparison with the establishment and operation of a fund solely by the water utility. In the latter case, a fund of $100,000 would be required to meet retirement expectancies of the Portland Water District. It has been decided to establish a minimum retirement annuity of 1 per cent of the average wage, and not less than $30.00 per month, at age 65—the same as the minimum required by the Federal Government for private employees. To purchase insurance policies, allowing such, would cost on the average $4,570 per male employee, and an added 5 per cent for female workers. To institute such, insurance companies have questioned that the Maine Water Districts have the authority without special legislation. The Committee's work had just begun, said Mr. Reny.

President Moulton pointed out that the real problem was the financing of retirement annuity for the older men, now more than half way to the retirement age. The

*R. K. Newcomb, Mgr., Skowhegan Water Co., Skowhegan, Me. (also manages four other plants of the North East System); Geo. D. Boulter, Trustee, Water Distr., Kittery, Me. (the long time Trustee and ex-Senator lost by a nose); J. W. Randlett, Supt. and Treas., Water Distr., Richmond, Me. (the "J" might stand for Judge, because he's that plus being Fire Chief, Police Chief, et al.*

*Maurice A. Libby, Supt. Water Distr., Bath, Me.; John B. Swaim, Mgr. Caribou Water Co., Caribou, Me.; Sam D. Soule, Supt. Water Distr., Gardiner, Me.*

**Dining on Lubec's Lawn**

*A superb setting between the pumping station and well-house showing at the far end.*

**Here and There During the Meeting**

*(1) Newcomb (Skowhegan), Soule (Gardiner), et al.; (2) on the lawn; (3) Sparks (Old Town), Manson (Calais), Frees (Bangor); (4) some of the fair sex awaiting luncheon; (5) Ye Ed. at work; (6) Lubec's Commissioner of Water, A. W. Pike (side view), Mrs. Pike and party.*

*L. R. Smith, Distr. Supt. Water Distr., Portland, Me.; A. B. Lamb, Water Wks. Engr., Skowhegan, Me.; R. E. Fergusson, Hersey Mfg. Co., Boston, Mass.*

*W. L. Sampson, Trustee, Water Distr., Dover-Foxcroft, Me.; W. D. Hutchins, Trustee, Water Dist., Augusta, Me.; W. J. Mayo, Supt. Water Distr., Dover-Foxcroft, Maine.*

$4,750 policy was sufficient per man for the younger men, and it would possibly prove better practice to take care of the older men as their retirement became imminent.

Mr. Moulton then discussed the dangers to municipal utility financing which existed in the present movement to do away with the tax free feature of municipal bonds. He thought that the Association should look into its interest in this quarter, because automatically water works costs would ascend and, with it, the employee of publicly owned utilities would then be taxed on his income. A motion to appoint a committee to observe developments and, if expedient, to act with other groups in combating any move to tax municipal bond interest and employees' salaries, was made and carried.

(Water Department heads who may be studying means of setting up a retirement annuity plan in his department would do well to correspond with the Chairman of the Maine Water Utilities Committee—Mr. Reny, at Portland—and study his first and subsequent reports, which include valuable retirement annuity costs and expectancy tables.—Ed.)

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## 4100 FIRE HYDRANTS FOR CHICAGO

So far this year Chicago has let contracts for 4,100 new fire hydrants built to specifications drawn by the Department of Public Works. The most recent order for 2,000 hydrants at a price of $90,000 was awarded Koppers Company (Western Gas Div.) of Fort Wayne, Ind., which company also supplied 2,100 hydrants on an earlier order.

In these days orders for 4,100 new hydrants, purchased within a 6-month period by one customer, sounds like "big-business." Moreover, in addition to hydrants Chicago, with P.W.A. assistance, has been spending pretty freely for gate-valves and C. I. pipe going into distribution system betterments and needed extensions.

## DISTINGUISHING BETWEEN CHLORAMINE AND "FREE" CHLORINE

To distinguish between "free," or hypochlorite, chlorine and chlorine in the chloramine form, a test involving the decolorizing power of the residual chlorine seems to serve as a practical method. In slightly acid solution "free" or hypochlorite chlorine will bleach dilute methyl-orange indicator added to 100 cc. samples, when present to the extent of as little as 0.02 p.p.m.

The following distinguishing test has been suggested by R. D. Scott, Chief Chemist, Ohio State Department of Health:

Dissolve 0.5 gram methyl orange in one liter of water. Dilute 5.9 cc. of this solution to 100 cc. If added to 100 cc. of water containing 0.1 p.p.m. free chlorine 1 cc. of this dilute methyl orange solution will be decolored upon acidifying the sample slightly.

Accordingly, after determining the alkalinity of the water to methyl-orange, using the standard indicator, add to another 100 cc. portion 2 cc. of N-10 acid in excess of that required to just neutralize the alkalinity. Add 0.2 cc. of the dilute methyl-orange indicator. If the pink color disappears, repeat the addition until the pink cast persists for at least 5 minutes. Each 1 cc. of indicator decolorized indicates 0.1 ppm. "free" chlorine.

From the total available (residual) chlorine, as measured by the orthotolidin method, deduct the "free" chlorine value and the residue can be, for all practical intent, assumed to be that residual in the form of chloramines.

(NOTE: In this test the possible presence of manganese (or nitrites, above 0.5 ppm. N.) must be considered and taken into account in correcting the total residual chlorine.)

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## "WATER SUPPLY AND SEWERAGE"

*A New Book*

"Water Supply and Sewerage," by Ernest W. Steel, Professor of Sanitary Engineering, A. & M. College of Texas, is a recent and up to date book published by McGraw-Hill Company, New York City. It is 6x9 inches, contains 653 pages and 262 illustrations. Price $5.00.

The author, who has produced other sanitary engineering texts, has assembled in this new book a compact presentation of the fundamentals of design, construction and operation of water works, purification plants, sewerage systems and sewage treatment plants. It covers such up-to-the-minute topics as surface-wash for filters; use of "flocculators"; modern economics and financing of water and sewage systems; their operation as utilities; trickling filter loadings, and the new high rate trickling filter; present status of chemical precipitation of sewage; modern sludge processing and disposal; modern chlorination practices. In many places subjects common to both water supply and sewerage have been treated together, thus conserving space and permitting the inclusion of additional valuable information.

This new book is offered on a 10 day free inspection basis. The cost is less than a penny a page. It is worthy, and definitely new.

# METHODS OF MEETING PEAK WATER DEMANDS*

## *Such as Those Created by Air Conditioning, Sprinkling, and Other Uses*

By W. V. WEIR
*Superintendent, St. Louis County Water Co., St. Louis County, Mo.*

*The Author*

TODAY the infant industry "Air Conditioning" is presenting one of the major problems in the field of water supply. A graph of summer air conditioning or refrigeration installations made in the past few years shows a curve rising at an accelerating rate. Where this curve will level off is impossible to say. We only know that for some time to come more and more water will be required for air conditioning and that this water will be needed during the season of peak water consumption. Because of these simple facts we properly recognize this additional water demand as a problem which will now, and in the future, require careful study.

Generally speaking, this newly created water demand will begin in May and will end in October each year. It will coincide with the present peak-load season. More water will be required on the hot days than on the cool days. The load will be an added increment to the present peak-load demand.

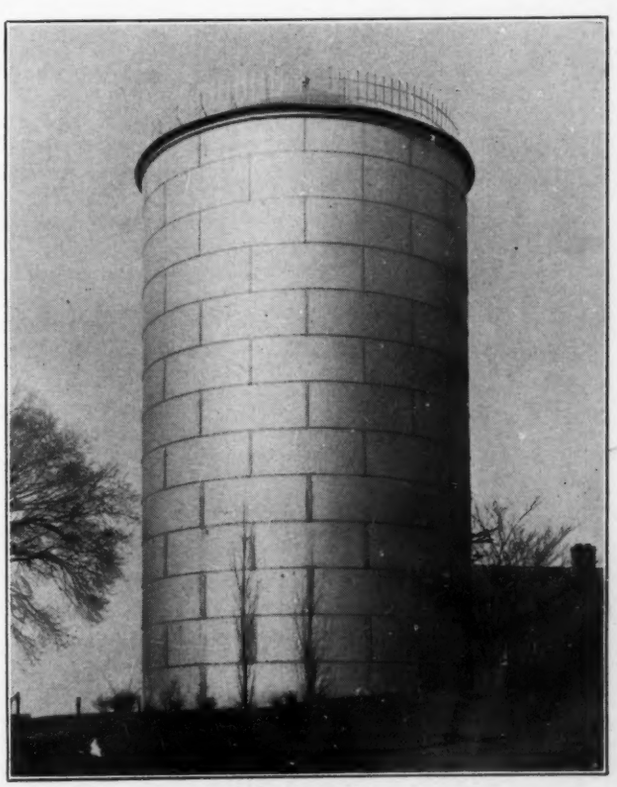
Most water plants and distribution systems as they are now built will take care of existing load. Since it will usually be impossible to refuse to take on this coming additional load, we are therefore confronted with the problem of reinforcing or making additions to our present water plants and distribution systems, or of reducing present peak loads so that the existing water systems will have capacity available to supply this additional water.

From a strictly engineering point of view the problem is not especially difficult, unless this new load develops so rapidly that it is impossible to keep ahead of it. This discussion will touch only two phases of what may be done in the way of construction to meet this new water demand. Consideration is then directed to the procedure of creating an off-peak demand to produce modified peaks on the demand curve.

### Elevated Storage

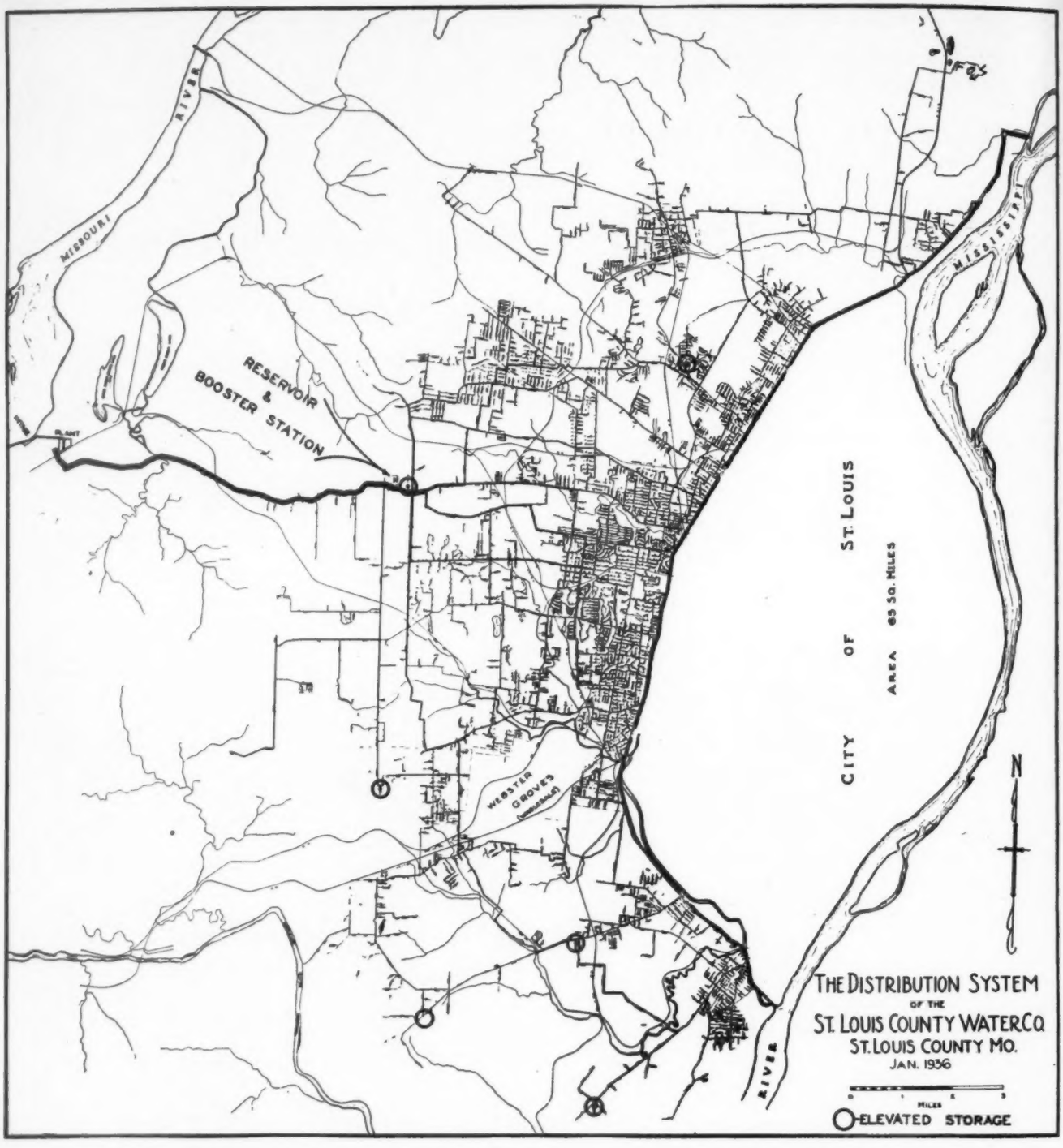
The accompanying Fig. 1 is a typical graph of water consumption on a peak day. This graph shows the actual water demand of the consumers of the St. Louis County Water Company on July 14, 1936. It actually represents the consumption characteristics during the peak day of our peak season. The consumers are mainly residential although fourteen country clubs and quite a number of truck gardeners are served. The population served was about 200,000 and the consumers were 99 per cent metered. To allow comparison with other systems the consumption is shown in gallons per capita per day.

The solid line represents the water taken out of the distribution system during the day. This curve is similar to other peak day curves which have appeared in water works publications from time to time. The broken line represents the water pumped into the distribution system. It will be noted that, in the late afternoon during the peak period, water was put into the distribution system at the rate of 197 gallons per capita per day, while it was being taken out at the rate of 220 gallons per capita per day. The difference between these figures represents the rate of drawdown of our elevated storage, which consists of five standtowers and two elevated



*One of the Five Standtowers Providing Elevated Storage for the St. Louis County Water Co.*

*A paper presented before the American Water Works Assn. and printed by permission of the Association.




*The Distribution System of the St. Louis County Water Company—Showing Locations of Elevated Storage and Ground Storage to Booster Stations.*

tanks. Approximately 10 per cent of the peak water demand was therefore supplied by the elevated storage, the cost of which, including the land occupied by the tanks, was less than 3 per cent of the cost of the plant and primary mains.

To have supplied the most difficult ten per cent of the peak demand by additions to the plant and mains would, however, have required more than a ten per cent additional investment cost. Any method which will accomplish these results with only a three per cent additional investment cost offers an economical method of taking care of additional water demand.

In the past our elevated storage has been allowed to "float on the line." This coming summer we are going to adopt a procedure, used by some other water systems, of conserving the storage during the hottest days until the heavy afternoon draft begins. The graph (Fig. 1) shows that we discharged a great deal of our supply of stored water into the distribution system between 7 a. m. and 3 p. m. and, in consequence, lost some of the benefits which result from having on hand the maximum elevated storage during the hours of peak consumption.

We realized that the elevated water storage in our sys-

tem does not represent that which can be considered as wholly adequate. In our system, and in a great many other systems, a very economical method of handling the additional water demand created by air-conditioning, or other uses, is the installation of more elevated storage.

## Repump Storage

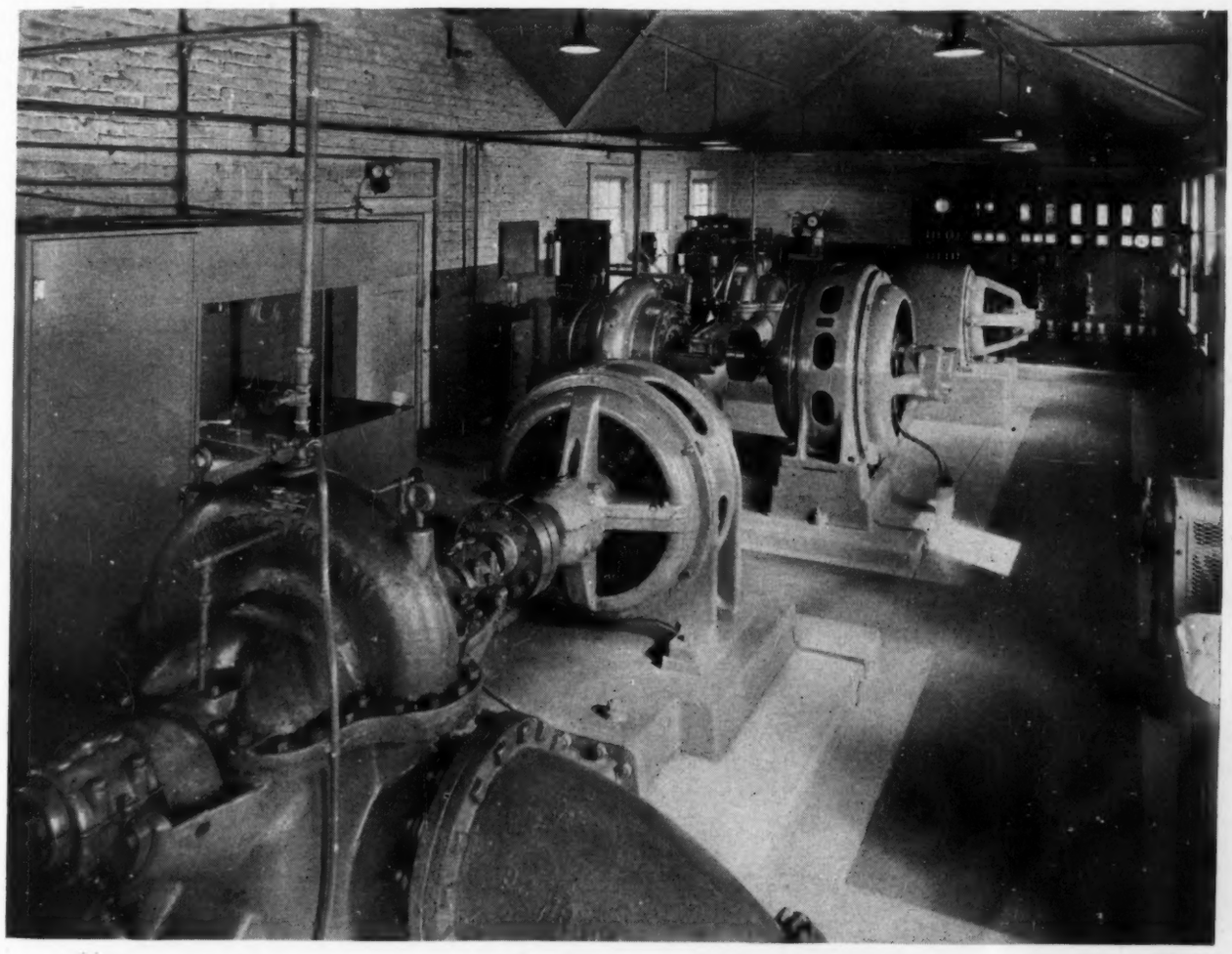
A variation in the use of stored water is the practice of installing "repump storage," consisting of reservoirs at ground level from which water is pumped to the distribution system during periods of above average demand. This method is especially deserving of study where the pumping and purification plant is remote from the distribution system. It enables the plan and transmission mains to operate at a nearly uniform rate. And, if off-peak power rates are available, it enables the plant to deliver a large quantity of water to the reservoir during this off-peak period, thus taking advantage of these lower power rates in producing pumping economies.

Fig. 2 shows as a broken line the pumpage into the distribution system of the St. Louis County Water Company for the peak day, July 14, 1936. The pumpage from the plant is shown as a solid line. It will be seen that the plant pumpage curve bears no resemblance to the actual water consumption curve. For eighteen hours of the day the plant pumped to the reservoir which is located eight miles away at an elevation 270 feet higher. For six hours (3 p. m. to 9 p. m.), the plant pumped direct into the distribution system, assisting the booster pumps in handling the peak load. It will be noticed that at no time during the on-peak hours did the main pumps or the booster pumps operate at a rate greater than 117 per cent of the average for the day, while the total water delivery during the peak period was 155 per cent of the average for the day.

The use of these booster pumps and reservoir has made unnecessary the construction of additional pumping and purification plant facilities, or additional transmission mains, to take care of the peak hour demands. The addition of a re-pump storage supply to an existing water works system, built for the maximum hourly load, will enable the plant and mains to handle a total daily consumption approximating the present maximum hourly rate. In other words, such an arrangement will allow the existing plant to handle maximum days 25 to 50 per cent greater than at present. Repump storage, therefore, deserves consideration as a method of meeting air conditioning water demand and other temporary or seasonal demands.

## Reducing Present Peak Loads

The most economical method of meeting growing water demands would be to do so with our present sys-



*Stratman Hill Booster Station of the St. Louis County Water Co.*
*Pump No. 1—350 H.P. Synchronous Motor; Pump No. 2—250 H.P. Induction Motor; Pump No. 3—500 H.P. Variable Speed Induction Motor.*

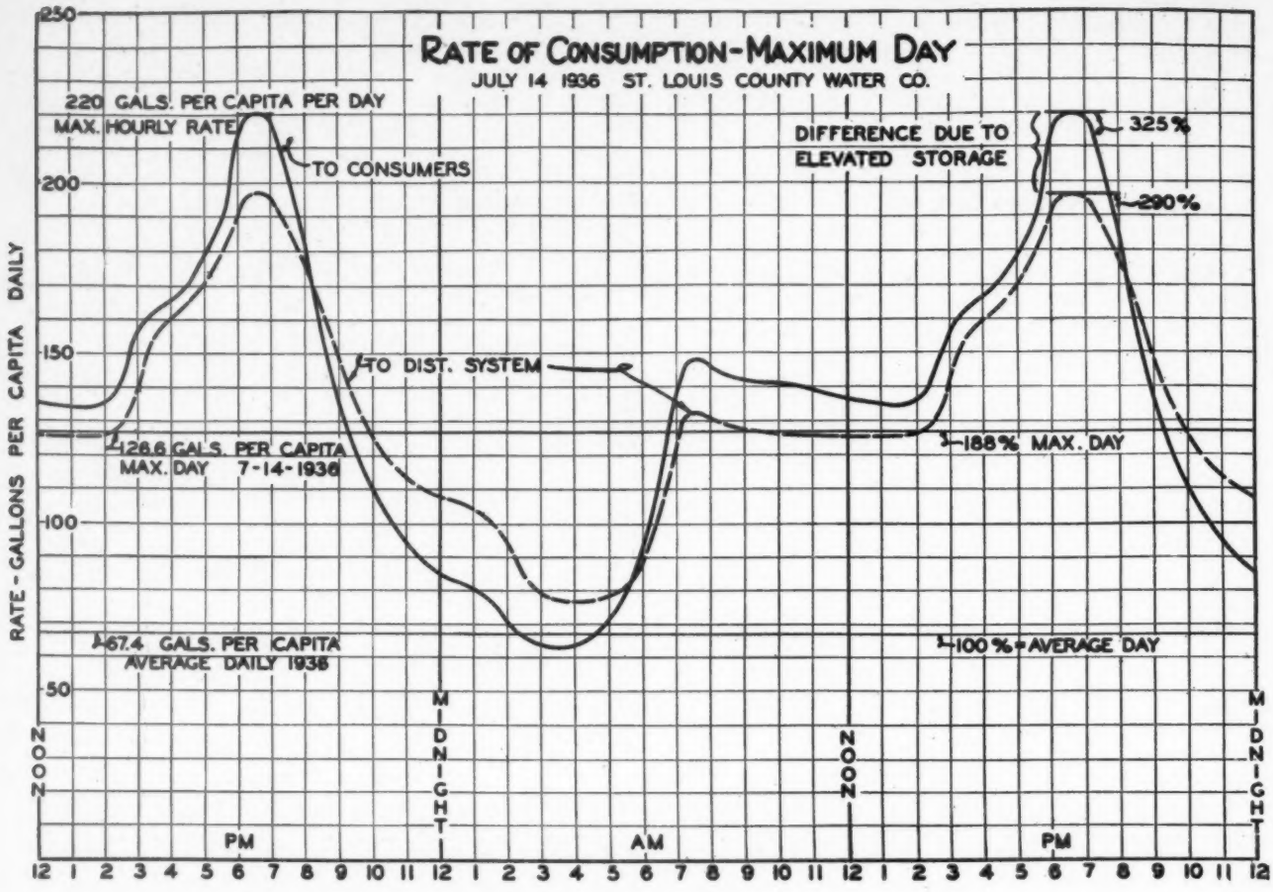



*Fig. 1—A Typical Graph for Water Consumption on a Peak Day.*

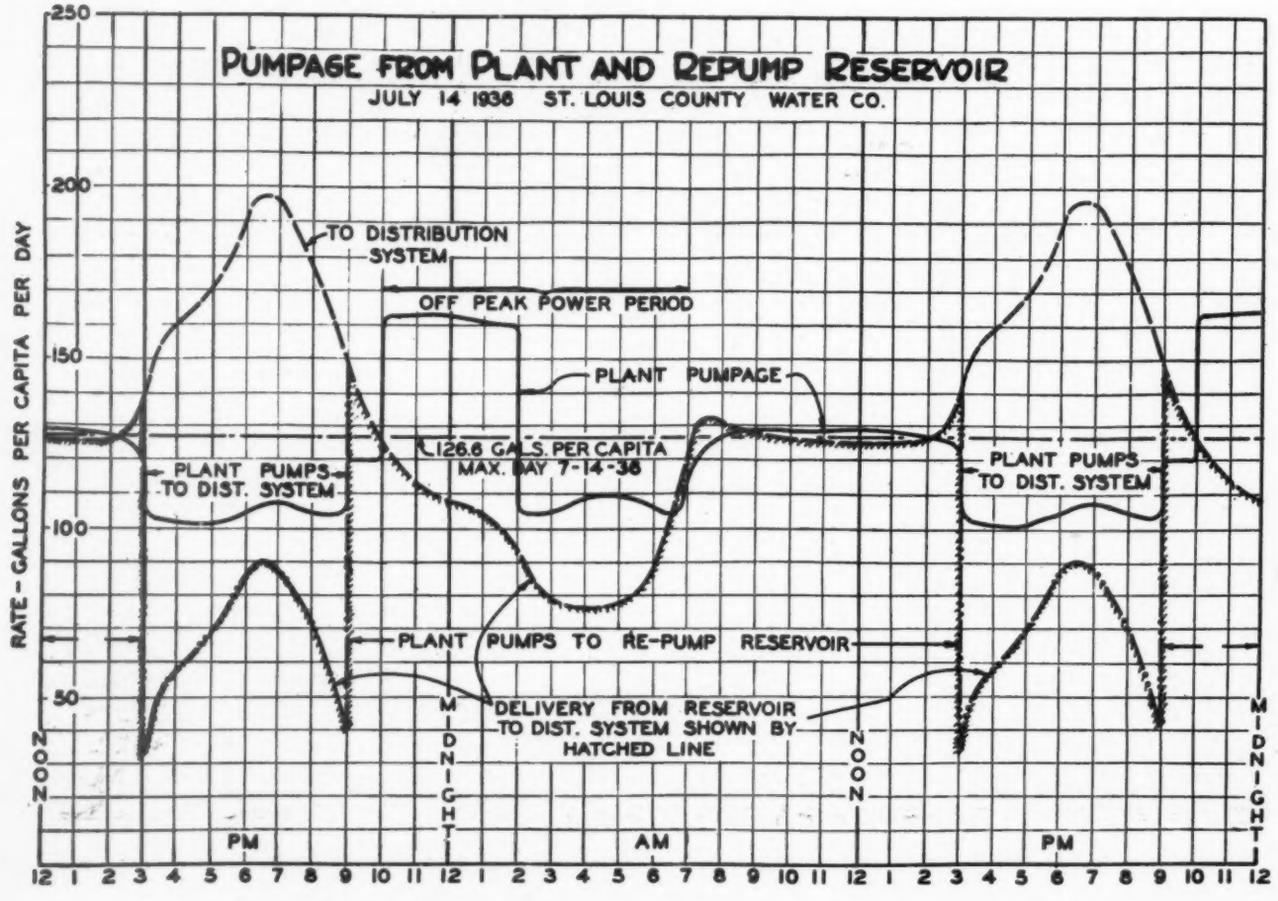



*Fig. 2—Graph Revealing Pumping Program and Effectiveness of Re-Pump Storage Arrangement.*

tems. If we make an effort to reduce existing peak demands, our systems, which are now built to handle such maximum demands, will have capacity available to supply additional water for growing air conditioning installations or other uses.

A further inspection of the graph in Fig. 1 will show the abrupt peak and the enormous valley in the curve of the consumers' water demand. In St. Louis County we have constructed a distribution system to handle for a short time 325 per cent of the average daily demand. Even on the peak day we only handled 58 per cent of the water the system was built to deliver.

Considering this as a typical consumption curve, it should be realized that it is very uncomplimentary to the management of the water works industry. There is probably no other industry with such a poor "load factor," which has not tried to do something to improve it. The usual effort is toward filling up the valley in the production curve. Admitting that there are very few available markets for additional water in the winter or during the night, there is still little excuse for not attempting some scheme designed to lower the peak hour requirements.

Few of us offer to sell water on an off-peak basis, yet many of us realize the advantage of taking power on that basis. A proper analysis of costs of production and rates will show that it would usually be advantageous to offer inducement rates which will make it worth while for certain consumers to refrain from taking water during the peak hours.

In St. Louis County, Mo., we have embarked on such a project in a small way. By making a reasonable reduction in water rates, we have already induced two large country clubs to confine the irrigation of greens and fairways to the hours between 9 p. m. and 7 a. m., and by so doing have relieved our system of a draft of 1,000 g.p.m. during the hours of normal peak demands.

We have barely touched the field of off-peak rates. The commercial irrigation load will probably be the best load to try to control by this device. Truck gardeners, greenhouses and golf clubs should be willing to refrain from using water during the peak hours of the summer season, provided a commensurate reduction in water cost is made available as a consideration.

In contemplating growing water demands for air conditioning there is a tendency to consider it as an undesirable load, because it comes during the peak season. However, the consumer who causes the wide variations in the load curve is the ordinary householder who feels that he has to sprinkle his lawn between 6 and 8 p. m. every evening. Air conditioning load is not nearly as undesirable as the sprinkling demand placed on the water system by the householder.

In an effort to correct this habit of sprinkling in the early evening hours, we distribute free a U. S. Dept. of Agriculture bulletin on "Planting and Care of Lawns" and keep repeating in our newspaper advertisements that (quoting from this bulletin) "during hot dry weather the lawn should be watered infrequently but thoroughly. . . . The lawn may be watered at any time of the day or night." If the consumer follows this advice he waters his lawn once or twice a week instead of every day. He also takes water over a longer period of time to get the proper amount of water on his lawn. We expect this program to reduce the maximum demand for water by rounding off the peak on the consumption curve and it will also give our consumers more blue grass and less crab grass in their lawns.

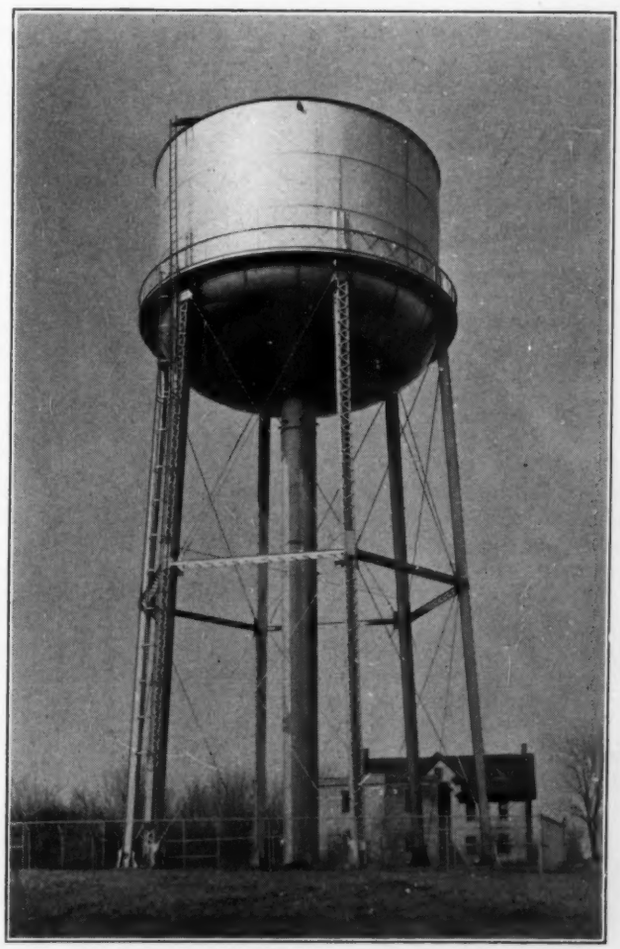
Some water departments offer reduced summer rates to encourage sprinkling. This may be all right where the water system is overbuilt, but usually an analysis will show that such reduced rates are undesirable and are exactly the reverse of what they should be. If rates are cut ten per cent for example, for summer use, they should logically be cut at least twenty per cent for the rest of the year when the water systems are greatly under loaded. If reduced rates are offered, the consumers should at least be made to agree to use no water for irrigation during the peak hours. Reduced summer rates and other practices which increase peak loads should be critically studied in the light of the increasing air conditioning demand.

This discussion has been an effort to illustrate three of many methods which may be used to meet the demands created by air conditioning.

*First*—That the proper use of elevated storage will enable the present distribution systems to handle additional load.

*Second*—That re-pump storage supplies will allow existing plants and transmission mains to operate at a more uniform rate and therefore handle considerably more total daily pumpage.

*Third*—That the promise of additional peak load due to air conditioning makes it urgent that steps be taken to reduce the present undesirable peaks in water consumption.



*Two 250,000-Gal. Elevated Tanks Provide Elevated Storage for the St. Louis County Water Co. This Tank Located at Sunset Hill*

# DEVELOPING A SEWER RENTAL PLAN

## *Experiences and Factors in Preparing the New Ordinance for Columbus, Ohio*

**BY ROBERT A. ALLTON**

*Consulting Engineer,*
*Division of Sewage Treatment, Columbus, Ohio*

THE City of Columbus, Ohio, has recently completed a $6,000,000 sewer construction program and a 50 m.g.d. sewage treatment works of the activated sludge type costing approximately $4,000,000. The construction of these works was financed by general obligation bonds voted by the people and by a grant from the Federal government through the PWA.*

*The Author**

Upon the completion of this program the city was confronted with the problem of financing the maintenance and operation of these works and it was decided that funds for this purpose should be raised by means of a sewer rental charge. The amount required for maintenance and operation of the sewerage system and the sewage treatment works was estimated at $331,000 for the year 1938. Sinking fund requirements are met by a tax levy.

### The Plan Selected

Several already tried methods of making the sewer rental charge were first painstakingly investigated. These methods, which were presented and analyzed and discussed before the 1938 Convention of the American Water Works Association in New Orleans, have, by permission of the Association, been presented in the August 1938 issue of this magazine as a forerunner of the present article.

As the result of our study, a charge based on water consumption was selected as being the most equitable. The sewer rental ordinance as finally adopted for Columbus provides for a charge per thousand cubic feet of water used on each premise. The charge, varying with the amount of water used, follows the breaks in the rate schedule for water. A tabulation showing the charges for water and for sewer rental appears in Table I. From this table it will be seen that for each consumption bracket, the sewer rental charge is approximately 34.5 per cent of the water charge.

The percentage of all accounts falling in each bracket and the percentage of the total metered water used by these accounts is shown in Table II.

The sewer rental charge is billed as a separate item on the water bill as shown in Fig. I. All accounts with a consumption greater than 30,000 cubic feet per month are billed monthly; all other accounts are billed semi-annually. For semi-annual accounts, the city is divided into three districts, and the meters are read and bills prepared for one district every other month.

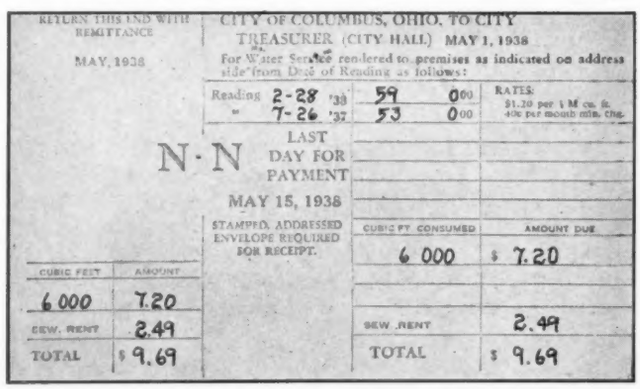
Provision is made for adjustment of the sewer rental charge for any account where a portion of the water used does not, and can not, enter the sewer system. In each such case an investigation of the water use is made by the city and the percentage of the metered water entering the sewer system is determined. After this percentage is determined, it is applied to each subsequent meter reading to determine the quantity of water on which the sewer rental charge is computed. If the customer is not satisfied that the quantity of water so determined is correct, he has the option of placing deducting meters in his water system in such a way as to measure

TABLE I—WATER AND SEWER RENTAL RATES—COLUMBUS, OHIO

| Consumption Brackets | Charges Per 1,000 Cu. Ft. Within City Limits: Water | Sewer Rental |
|---|---|---|
| First 25,000 cu. ft. per month | $1.20 | $0.415 |
| Next 175,000 cu. ft. per month | 1.15 | 0.400 |
| Next 800,000 cu. ft. per month | 1.10 | 0.380 |
| Next 1,000,000 cu. ft. per month | 1.00 | 0.345 |
| Over 2,000,000 cu. ft. per month | 0.60 | 0.205 |
| Minimum annual charge | 4.80 | 1.66 |

TABLE II—DISTRIBUTION OF WATER ACCOUNTS—COLUMBUS, OHIO

| Annual Water Consumption | Pct. of Accounts | Pct. of Metered Water |
|---|---|---|
| Less than 4,000 cu. ft. (minimum charge) | 34.48 | 6.10 |
| More than 4,000 cu. ft.; less than 300,000 cu. ft. | 65.03 | 48.42 |
| More than 300,000 cu. ft.; less than 2,400,000 cu. ft. | 0.44 | 21.86 |
| More than 2,400,000 cu. ft. | 0.05 | 23.62 |


RETURN THIS END WITH REMITTANCE

MAY, 1938

CITY OF COLUMBUS, OHIO, TO CITY TREASURER (CITY HALL) MAY 1, 1938

For Water Service rendered to premises as indicated on address side from Date of Reading as follows:

Reading 2-28 '38 — 59 00
" 7-26 '37 — 53 00

RATES: $1.20 per 1 M cu. ft. 40c per month min. chg.

N·N LAST DAY FOR PAYMENT MAY 15, 1938

STAMPED, ADDRESSED ENVELOPE REQUIRED FOR RECEIPT.

| CUBIC FEET | AMOUNT |
|---|---|
| 6 000 | 7.20 |
| SEW. RENT | 2.49 |
| TOTAL | $ 9.69 |

| CUBIC FT. CONSUMED | AMOUNT DUE |
|---|---|
| 6 000 | $ 7.20 |
| SEW. RENT | 2.49 |
| TOTAL | $ 9.69 |

*Figure I—Specimen Water and Sewer Rental Bill. The Left Third of the Card Is the Cashier's Stub Which is Detached for Identification of Payments Made. Actual Size of Card 3¼x5½ In.*

*The author of this article was in direct charge of design and construction of Columbus' new treatment works with its many innovations in design and operation. He has since been placed in charge of operating and managing the works which he designed. —Ed.

the quantity of water which does not enter the sewer. The quantity of water so measured is deducted from the total quantity of water entering the premises, to determine the quantity of water on which the sewer rental charge is to be computed.

In the case of sewer users provided with a private water supply, the ordinance provides that a water meter must be placed on this supply and the meter is read, and the sewer rental charge computed, just as though the user was taking water from the municipal supply.

For premises outside of the city limits, the procedure is the same as for premises within the city limits, except that the charge per thousand cubic feet is increased so that the nontaxed sewer user will bear a portion of the sinking fund charges.

## The Ordinance

In drawing up the ordinance every endeavor was made to make procedures explicit. Such was done in order to reduce to a minimum anticipated controversies in the determination of the proper sewer rental charge. For the benefit of those interested, the ordinance follows. [Certain preambles and sections nullifying existing named ordinances have been omitted.—Ed.]

AN ORDINANCE NO. 331-37.—To provide funds for the operation, maintenance, management, repair, enlargement and replacement of the sewerage system, regulator chambers, storm stand-by tanks, pumping stations and sewage treatment works of the city of Columbus, Ohio.

(At this point all existing ordinances to be repealed are listed by numbers and dates.—Ed.)

Whereas, the council of the city of Columbus finds that in order to pay the cost of the operation, maintenance, management, repair and replacement of the sewerage system, regulator chambers, storm stand-by tanks, pumping stations and sewage treatment works, it is necessary to fix and collect a charge or rental upon the lots, lands and premises served by sewerage connections with the sewerage system of said city; now, therefore,

Be it ordained by the council of the city of Columbus:

Section 1. That it is hereby determined and declared to be necessary to the protection of the public health, safety, welfare and convenience of the city of Columbus, Ohio, to fix and collect charges or rentals upon all lots, lands and premises served by having connections with the sewerage system and by the regulator chambers, storm stand-by tanks, pumping stations and sewage treatment works of said city.

Sec. 2. That the funds received from the collections of such charges or rentals, as hereinafter authorized, shall be deposited daily with the city treasurer and shall be accounted for and known as the sewer fund, and, when appropriated by the council of the city of Columbus, shall be available for the payment of the cost and expenses of the operation, maintenance, management and repair of the sewerage system, regulator chambers, storm stand-by tanks, pumping stations and sewage treatment works and any surplus in said fund may be used for the enlargement or replacement of same and for the payment of the interest on any debt incurred for the construction of such sewerage system, regulator chambers, storm stand-by tanks, pumping stations and sewage treatment works and for the creation of a sinking fund for the payment of such debt, but *shall not be used* for the extension of a sewerage system to serve unsewered areas or *for any other purpose whatsoever.*

Sec. 3. That for the purpose provided in sections 1 and 2 hereof, there is hereby charged to each lot, parcel of land, building or premises having any active sewer connection with the sewerage system of said city or otherwise discharging sewage, industrial wastes, water or other liquids, either directly or indirectly, into the city's sewerage system, a sewer charge or rental, payable as hereinbefore provided, and in the amount determinable as follows:

(a) For any lot, parcel of land, building or premises situated within the corporate limits of the city of Columbus, Ohio, and having any connection with the city's sewerage system or otherwise discharging sanitary sewage, industrial wastes, water or other liquids, either directly or indirectly into the city's sewerage system, said charge or rental shall be based upon the quantity of water used thereon or therein as the same is measured by a water meter or meters there in use, as hereinafter described, and there shall be charged;

For each thousand cubic feet of water used, not exceeding 150,000 cubic feet, per half year, or a period of time equaling a half year, at the rate of forty-one and one-half cents per thousand cubic feet;

For each thousand cubic feet of water used in excess of 150,000 cubic feet, and not exceeding 1,200,000 cubic feet, per half year, or a period of time equaling a half year, at the rate of forty cents per thousand cubic feet;

For each thousand cubic feet of water used in excess of 1,200,000 cubic feet, and not exceeding 6,000,000 cubic feet, per half year, or a period of time equaling a half year, at the rate of thirty-eight cents per thousand cubic feet;

For each thousand cubic feet of water used in excess of 6,000,000 cubic feet, and not exceeding 12,000,000 cubic feet, per half year, or a period of time equaling a half year, at the rate of thirty-four and one-half cents per thousand cubic feet;

For each thousand cubic feet of water used in excess of 12,000,000 cubic feet per half year, or a period of time equaling a half year, at the rate of twenty and one-half cents per thousand cubic feet;

Provided, that the minimum charge shall be eighty-three cents per half year, or any part thereof.

(b) For any lot, parcel of land, building or premises situated outside of the corporate limits of the city of Columbus, Ohio, and having any connection with the city's sewerage system or otherwise discharging sewage, industrial wastes, water or other liquids, either directly or indirectly, into the city's sewerage system, said charge shall be based upon the quantity of water used thereon or therein as the same is measured by a water meter or meters there in use, as hereinafter described, and there shall be charged:

For each thousand cubic feet of water used not exceeding 150,000 cubic feet per half year, or a period of time equaling a half year, at the rate of forty-five and one-half cents per thousand cubic feet;

For each thousand cubic feet of water used in excess of 150,000 cubic feet, and not exceeding 1,200,000 cubic feet per half year, or a period of time equaling a half year, at the rate of forty-four cents per thousand cubic feet;

For each thousand cubic feet of water used in excess of 1,200,000 cubic feet, and not exceeding 6,000,000 cubic feet per half year, or a period of time equaling a half year, at the rate of forty-two cents per thousand cubic feet;

For each thousand cubic feet of water used in excess of 6,000,000 cubic feet, and not exceeding 12,000,000 cubic feet, per half year, or a period of time equaling a half year, at the rate of thirty-eight cents per thousand cubic feet;

For each thousand cubic feet of water used in excess of 12,000,000 cubic feet per half year, or a period of time equaling a half year, at the rate of twenty-two and one-half cents per thousand cubic feet;

Provided, that the minimum charge shall be ninety-one cents per half year or any part thereof.

(c) In the event a lot, parcel of land, building or premises discharging sanitary sewage, industrial wastes, water or other liquids into the city's sewerage system, either directly or indirectly, is a user of water supplied by the division of water of the city of Columbus, Ohio, and the quantity of water used is measured by a water meter acceptable to the director of public service, then, in each such case, the quantity of water used, as measured by said meter, shall be used to determine the sewer charge or rental as provided in this ordinance.

(d) In the event a lot, parcel of land, building or premises discharging sanitary sewage, industrial wastes, water or other liquids into the city's sewerage system, either directly or indirectly, is a user of water supplied by the division of water of the city of Columbus, Ohio, and the quantity of water used is not measured by a water meter or is measured by a water meter not acceptable to the director of public service, then in each such case, the owner or other interested party shall at his expense install and maintain a water meter acceptable to the director of public service and the quantity of water used, as measured by said meter, shall be used to determine the sewer charge or rental as provided in this ordinance.

(e) In the event a lot, parcel of land, building or premises discharging sanitary sewage, industrial waste, water or other liquids into the city's sewerage system, either directly or indirectly, is not a user of water supplied by the division of water of the city of Columbus, Ohio, and the water used thereon or therin is not measured by a water meter or is measured by a water meter not acceptable to the director of public service, then, in each such case, the owner or other interested party shall at his expense install and maintain a water meter acceptable to the director of public service and the quantity of water used, as mea-

ured by said meter, shall be used to determine the sewer charge or rental as provided in this ordinance.

(f) In the event a lot, parcel of land, building or premises discharging sanitary sewage, industrial waste, water or other liquids into the city's sewerage system, either directly or indirectly, is a user of water supplied by the division of water of the city of Columbus, Ohio, and in addition, uses water from another source which is not measured by a water meter or is measured by a water meter not acceptable to the director of public service, then, in each such case the owner or other interested party shall at his expense install and maintain water meters satisfactory to the director of public service on all supplies and the quantity of water used to determine the sewer charge or rental shall be the sum of the quantities of water measured by the said several meters.

(g) In the event a lot, parcel of land, building or premises discharges sanitary sewage, industrial wastes, water or other liquids into the city's sewerage system, either directly or indirectly, and uses water in excess of 5000 cubic feet per half year, or a period of time equalling a half year and it can be shown, to the satisfaction of the director of public service, that a portion of the water as measured by the water meter or meters does not and cannot enter the sewerage system, then the director of public service may determine in such manner and by such method as he may find practicable the percentage of metered water entering the sewerage system and the quantity of water used to determine the sewer charge or rental shall be that percentage so determined, of the quantity of water measured by the water meter or meters, or the director of public service may require or permit the installation of additional meters in such a manner as to determine the quantity of water actually entering the sewerage system, in which case the quantity of water used to determine the sewer charge or rental shall be the quantity of water actually entering the sewerage system as so determined.

(h) The sewer charge or rental provided in this ordinance shall be payable semi-annually at the office of the city treasurer and, at the option of the director of public service may be made payable at the same time as the water bill for the lot, parcel of land, building or premises is payable.

Sec. 4. That for any lot, parcel of land, building or premises from which connection is made with the city's sewerage system or which begins to discharge sewage, any industrial waste, water or other liquids into the city's sewerage system, either directly or indirectly after this ordinance becomes effective, a charge shall be made pursuant to this ordinance, the same to be a per diem pro rata amount based upon the minimum charge per half year from the time such sewer connection is made, or such discharge into the city's sewerage system, either directly or indirectly, is begun, until the next following half-yearly peroid, except should the measured service exceed the minimum charge, the corresponding measured rate or rates shall be charged.

Sec. 5. That the sewer charge or rental charged under this ordinance shall be payable as provided in section 3, paragraph (g) hereof, provided that the amount of the rental payable for any lot, parcel of land, building or premises at the first payment period after this ordinance becomes effective shall be determined on the basis of a per diem proratement of the minimum charge herein established beginning with the date this ordinance becomes effective, except that in those cases in which the metered or measured charge exceeds the minimum charge, the metered or measured charge shall be the basis.

Sec. 6. That *each sewer charge* or rental charged under or pursuant to this ordinance is hereby *made a lien* upon the corresponding lot, parcel of land, building or premises served by a connection to the sanitary sewerage system of the city of Columbus, Ohio, and, if the same is not paid within ninety days after it shall be due and payable, it shall be certified to the auditor of Franklin county, Ohio, who shall place the same on the tax duplicate of said county with the interest and penalties allowed by law and be collected as other taxes are collected.

Sec. 7. That the sewer charges or rentals charged pursuant to this ordinance shall be *collected by the department of public service*, and the director of public service shall make and enforce such by-laws and regulations as may be deemed necessary for the safe, economical and efficient management and protection of the city's sewerage system, regulator chambers, storm standby tanks, pumping stations and sewage treatment works, for the construction and use of house sewers and connections to the sewerage system, and for the regulation, collection, rebating and refunding of such charges and rentals.

Sec. 8. That the director of public service shall and is hereby authorized to enter into agreements with the county of Franklin, state of Ohio, and with cities and villages and with corporations and individuals whose premises are located without the corporate limits of the city of Columbus, who desire to discharge sewage, industrial wastes, water or other liquids into the city's sewerage system; which agreements shall fix the terms and conditions under which said sewage, industrial wastes, water or other liquids may be discharged into said sewerage system and shall be in conformity with the other sections of this ordinance.

Sec. 9. That for the purpose of this ordinance, the items "sanitary sewage" and "industrial wastes" shall be defined as follows:

(a) "Sanitary Sewage" is hereby defined as the waste from water closets, urinals, lavatories, sinks, bath tubs, showers, household laundries, cellar floor drains, garage floor drains, bars, soda fountains, cuspidors, refrigerator drips, drinking fountains and stable floor drains.

(b) "Industrial Wastes" are hereby defined as being the liquid waste resulting from any commercial, manufacturing or industrial operation or process.

Sec. 10—(Lists by numbers and dates all ordinances being repealed.—Ed.)

Sec. 11. That each lot, parcel of land, building or premises which is exempt from water rental shall be exempt from sewer rental.

Sec. 12. That this ordinance shall take effect and be in force from and after the earliest period allowed by law and shall remain in force for a period of three years.

Passed and approved July 23, 1937.

FRANK C. KARNS, President of Council.
MYRON B. GESSAMAN, Mayor.

▼

## BERNARD L. CROZIER DIES

### Baltimore's Engineer-Lawyer

*B. L. Crozier*

Bernard L. Crozier, chief engineer of the Department of Public Works of Baltimore, died on July 23rd after an illness of about two weeks. He was 48 years old, the accompanying snapshot of the deceased having been taken during the recent meeting of the Maryland-Delaware Water and Sewage Works Association, which he addressed only a short time before his death.

From Alabama Polytechnic Institute, Mr. Crozier graduated in 1907 a civil engineer. While employed on engineering work in Baltimore he studied law and was in 1911 admitted to the Maryland bar. In 1912 he took a position as assistant-engineer with the Baltimore Paving Commission and rose to the top, becoming Highway Engineer of Baltimore in 1923. In 1925 he accepted the position of Chief Engineer of Baltimore's Department of Public Works.

▼

## JOHN W. BIRKINBINE PASSES

John Leibrandt Weimer Birkinbine, died July 17, at his home in Cynwyd, Pa. He was 60 years old and had been a practicing consulting engineer.

Mr. Birkinbine was born in Lebanon, Pa., was graduated by the University of Pennsylvania in Civil Engineering, spent much of his early engineering career in Mexico. In 1915 he succeeded his father as head of the Birkinbine Engineering Offices in Philadelphia, and continued to practice until ill health forced his retirement about a year ago. During his latter years he served the National Tube Company as Consulting Engineer, and was active in studies of corrosion, its prevention, and adaptations of steel pipe. He was a contributor to the technical literature and served as special member of several technical committees; was a member of, and well known in, the leading professional societies and technical associations in the field of hydraulics and water supply engineering.

# EFFECT OF SILICATE TREATMENT ON QUALITY OF WATER

By JOHN R. BAYLIS*
*Associate Editor*

DATA have been given in earlier articles[1] to show that acid-treated sodium silicate aids the coagulation of water with aluminum sulfate. The silicate was prepared by diluting 42° Baume sodium silicate to produce a solution containing approximately 5 per cent sodium silicate, and then adding sulfuric acid until the alkalinity of the solution was about 1,200. This specially prepared silicate not only hastened the formation of the coagulation but also strengthened the coagulated particles; that is, it made the masses of flocculated materials more difficult to break up by agitation, once formed in the water. This being true, it was stated that there should be less coagulated matter passing through filter beds when the silicate treatment is used. The data given herein will show such to be a fact. Another purpose of this article is to show the advantage of using cotton plug filters for comparing filter efficiency, as described in the August, 1937, issue of WATER WORKS AND SEWERAGE.

Heretofore it has been impossible to compare accurately filters producing good and better quality of water, because no instrument capable of detecting minute amounts of coagulated matter in water was available. Filter plant operators assume when the water is perfectly clear, according to present methods of testing, that no coagulated matter passes through the filters. This is not the case, for, regardless of how well the water is conditioned, an extremely small amount of coagulated matter may remain in the filtered water. Filters operated in the most efficient manner have been found to pass a small amount of coagulated matter when the tests are made by the improved method which involves use of the cotton-plug filters.

The improved method of determining small amounts of coagulated material in filter effluents involves passing a small stream of the filtered water through a cotton plug filter, and burning the cotton to determine the ash of the material retained by the cotton. The filter is composed of a small glass filtering tube about one inch inside diameter and about 3.5 inches long for the enlarged portion of the tube. One-gram portions of absorbent cotton are placed in the bottom of the filter tube which is connected to the effluent of a filter. The cotton does not have to be packed tightly, though tight enough to prevent passage of coagulated material. A tightly packed tube produces too much loss of head and this is not necessary to catch the coagulated matter which passes through a filter bed.

The flow of water through the cotton plug should be regulated so that it is constant, regardless of the loss of head on the filter. The article in the August, 1937, issue of this magazine to which reference has been made, describes the regulating device here illustrated. It is essentially a small float-tank with a calibrated orifice leading from the tank. A small stream of water from the large filter effluent line passes through the cotton plug filter, and into the float tank. The float maintains a constant level in the tank which gives a constant head on the glass tip orifice.

The increased toughness of the coagulation, produced by use of the acid-treated sodium silicate, offers the possibility of using a higher rate of filtration than is generally used, and also the use of coarser filtering material than is now the practice. To test these assumptions, five of the plant filters in the Chicago Experimental Filtration Plant were arranged for such experiments. The filters which were used have 10 sq. ft. of filtering surface per unit. This size filter is large enough for securing reliable information. The beds of the filters were reconstructed except for Filter No. 11 which contained filtering material of the desired size.

Table 1 shows the size of filtering material used in the five filters. Filter No. 10 contained a bed of anthracite coal. The filters were set to operate at 3.2 gallons per sq. ft. per min. The coarse filtering material in some of the beds, and the rapid rate of filtration, naturally caused considerable coagulated matter to pass through the beds of the coarsest material.

### The Effects of Low Temperature

The period from January to May, 1938, was an unusually good one for making comparison of the filters and method of treatment, for there were several periods when conditions in the Lake Michigan water were such that the floc formed by treatment with coagulant alone was weak and penetrated deeply into the filter beds. The exact cause of the periods of weak coagulation is not known, though such periods almost invariably occur when the water is at a low temperature. The low temperature and lack of suspended matter in the water, which helps reinforce the coagulation, probably are the major causes. But, in addition, there appears to be an unknown influence. Probably these two and the unknown influence are all essentials in the production of very weak coagulation. Regardless of the cause, there are times when it is difficult to prevent the passage of coagulated matter through filter beds if the sand is as coarse as that now in extensive use.

It is these periods of weak coagulation which limit the size of sand and rate of filtration which may be used in a filtration plant if water of the highest quality is to be assured all the time. There is not much difficulty in the summer months in obtaining a good quality of water, with very coarse filtering material or with a high rate of filtration; whereas, during winter months the filtered water may contain some coagulated matter. The poorly coagulated water prevailed over a period of several

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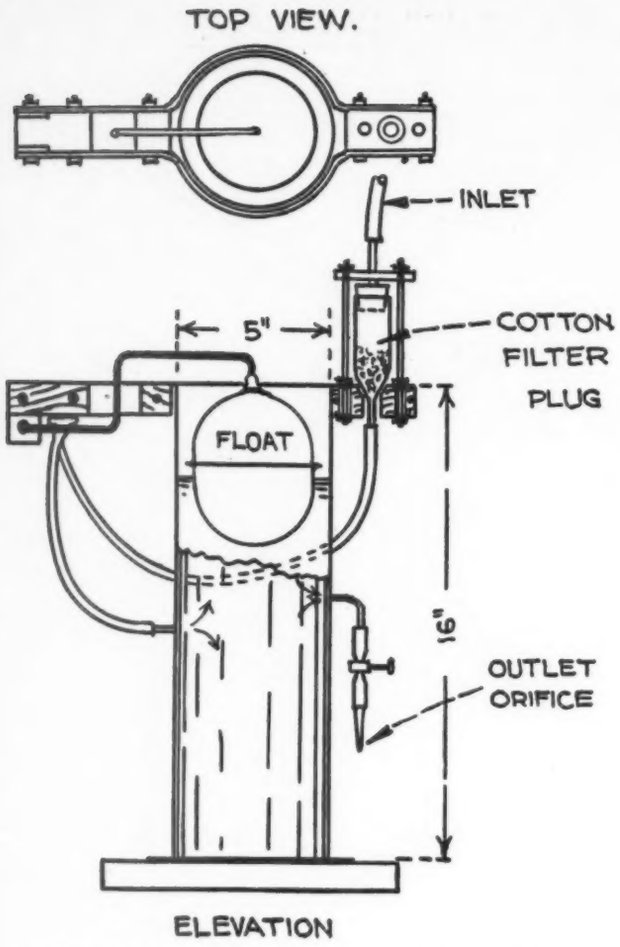



*Sketch of Cotton Plug Filter Used in Comparing Filter Efficiencies*

weeks during the course of the experiments, affording an excellent opportunity for testing the silica treatment.

### Method of Using the Cotton-Plug Filters

The cotton plug filters were connected with rubber tubing to the filter effluents and were set low enough so that they would continue in operation even when the plant filters were at their maximum loss of head. The orifices were calibrated to give a rate of flow between 100 and 175 ml. per minute. The cotton plugs were inserted in the filter tubes, the filters placed in operation, and a record made of the time started, and the rate at which the water was flowing through them at the beginning of the run. Just before they were cut off for removal of the cotton plugs, the rates of flow through the orifices were again determined. Frequently there were slight differences in the rate, and when this was the case the average of the rate at the beginning and the end of the run was used in computing the water which had passed through the cotton plug.

When a cotton plug filter was cut off for removal of the cotton, the water was allowed to drain from the filter, then the cotton was removed, using care not to dislodge any of the suspended matter within the cotton. If handled carefully, it is believed there is almost no loss of the suspended material in removing the plugs. The wads of cotton appear to give complete removal of the coagulated material in the water passing through them.

There may be question as to the best method of determining the amount of suspended matter. Since it is not easy to dry cotton to a definite weight, burning the material at a high temperature appears to be the best procedure. Table 2 shows the p.p.m. of ash in the filtered water as determined with the cotton plug filters. It is assumed that the amount of suspended matter in a particular water is in proportion to the ash.

The filters were run most of the time between February 15th and July 13th, 1938. There were periods in which they were not run for several days or two or three weeks. This was caused either by part of the plant being out of service or at times when treatment was not representative of typical plant operation.

### Results—

During the period when the water was cold all of the filters, at times, passed a large amount of coagulated matter when the acid-treated sodium silicate was not used with the coagulant. The small amount of suspended matter caught when silica was used, as compared with that caught during periods when it was not used, is significant. There was only about one-tenth as much coagulated matter passing the filters when the silicate treatment was used. This ratio holds very well for the coarser filtering materials as well as material near that of the size now in extensive use, and indicates the coagulated matter is more completely removed when the silicate treatment is employed.

The results in Table 2 show that, when a coagulant only was used, there was one period of two months, in which the amount of coagulated matter passing filter No. 11, [the filter having sand of smallest size used in the tests] was sufficient for the water to be considered of poor quality. Turbidity tests (not given in the table) were made at frequent intervals and there were times when the turbidity could be detected by tests made in the usual manner. Based upon turbidity tests, above, there were only two periods (March 4th-12th, and March 18th-21st) when a coagulant only was used, in which the water would have been regarded as being unsatisfactory. Since all of the filters were not in service during one of these periods, it is not included in Table 2. This clearly indicates the superiority of the cotton plug method for comparing filter efficiency, for they show there was a much more extensive period in which the filtered water was of inferior quality. When acid-treated sodium silicate and aluminum sulfate were used, the water filtered perfectly clear through filter No. 11 all of the time, and the amount of coagulated material retained on the cotton plugs from this filter was small.

### Considering the Size of Filtering Material

The results for filter No. 10 (containing Anthrafilt) were similar to those obtained on filter No. 11, except both the turbidity tests and the ash determinations showed that somewhat more suspended matter passed this filter than passed filter No. 11. Very good results were obtained on filter No. 7 when the water was treated with acid-treated sodium silicate. When the silica was not used, considerable coagulated matter passed through the filter. This filter contained filtering material having an effective size of 0.770 mm. dia. The tests indicate that this size filtering material may be used with safety under the worst condition of the Lake Michigan water at Chicago, provided acid-treated sodium silicate is used to aid the coagulation, whereas it could not be used if the usual methods of coagulating water is practiced.

Filtering material 1.00 mm. effective size is approaching the limit in maximum size of material which may be used when the water is treated with the acid-treated

TABLE 1

| Filter Number | Size of Filtering Materials: Effective Size (mm.) | Effective Size Range | 10 Per Cent Size (mm.) |
|---|---|---|---|
| 11 | .606 | 68† | 0.57† |
| 10* | .617 | 20† | 0.67† |
| 7 | .770 | 43 | 0.80 |
| 6 | 1.08 | 27 | 1.03 |
| 5 | 1.56 | 43 | 1.64 |

*Filter No. 10 had a bed of Anthrafilt.
†Samples from top 6 inches.

sodium silicate and aluminum sulfate. According to Table 2, and to the turbidity tests which were made (not given in the table) filter No. 6, with sand of an effective size of 1.08 mm., passed a small amount of coagulated matter on two occasions when silica was used. This could have been avoided by a higher dosage of the silicate. Filter No. 5, with sand of 1.56 mm. dia. effective size, is too coarse for the silica treated water, though much less coagulated matter passed during periods when the silica was used.

The amount of aluminum sulfate used during the course of the experiments given in Table 2 varied from 7 to 22 p.p.m. depending on the amount required to coagulate the water. The silica used, expressed as $SiO_2$, was approximately 40 per cent of the aluminum sulfate, except that at times a lower amount of silica than this ratio was added.

### How Much Ash Is Acceptable?

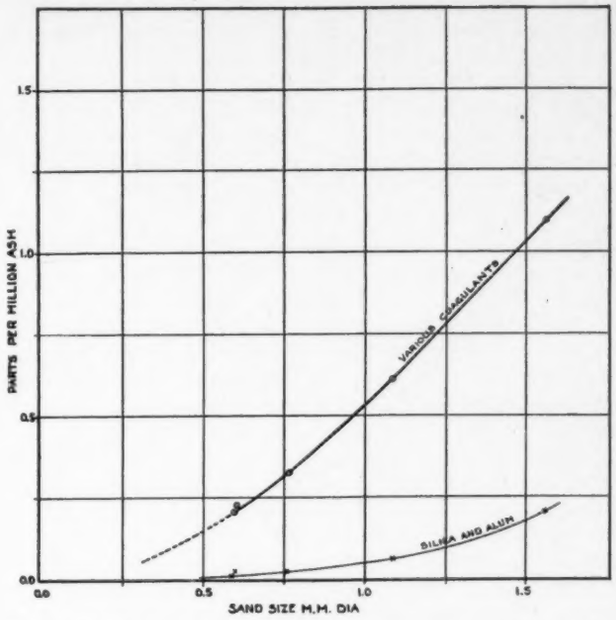
The amount of ash obtained occasionally is very much more than should be expected, when compared with the amount obtained upon the other plugs. The cause is

TABLE 2

Coagulated Matter Passing Filters Determined by Refiltering Through Cotton Plug Filters

| Date | Treatment | Size of material in mm.: .606 | .617 | .770 | 1.08 | 1.56 |
|---|---|---|---|---|---|---|
| | | Filter Numbers: 11 | 10† | 7 | 6 | 5 |
| | | P.P.M. Ash | | | | |
| Feb.— | | | | | | |
| 15 | Alum | .070 | .330 | .230 | .810 | 1.290 |
| 16 | Alum | .150 | .350 | .340 | 1.160 | 1.550 |
| 17 | Alum | .180 | .800 | .410 | 1.130 | 1.530 |
| 18 | Alum | .110 | .110 | .230 | .650 | 1.840 |
| 21 | Alum | .056 | .125 | .270 | .790 | .... |
| 23 | Silica and alum | .037 | .039 | .102 | .099 | .197 |
| 23 | Silica and alum | .020 | .085 | .019 | .070 | .250 |
| 25 | Silica and alum | .012 | .031 | .021 | .039 | .285 |
| 28 | Alum | .965 | 1.140 | 1.220 | 2.050 | 3.510 |
| 28 | Alum | 1.180 | 2.460 | 2.340 | 3.000 | 4.770 |
| March— | | | | | | |
| 1 | Alum | 1.840 | .204 | 2.090 | 4.020 | 6.810 |
| 1 | Silica and alum | .022 | .089 | .017 | .057 | .134 |
| 2 | Silica and alum | .010 | .019 | .011 | .016 | .221 |
| 4 | Alum | .337 | .108 | .340 | .602 | 2.750 |
| 4 | Alum | .764 | .505 | .527 | 1.200 | 2.800 |
| 4 | Alum | 1.200 | 1.440 | 1.150 | 1.720 | 3.050 |
| 5 | Alum | .591 | .619 | 2.730 | 2.950 | 4.980 |
| 7 | Alum | 1.900 | 1.750 | .900 | 4.130 | 5.800 |
| 8 | Partially alum | .656 | .230 | .290 | .071 | .950 |
| 9 | Silica and alum | .667 | .027 | .016 | .115 | .301 |
| 11 | Silica and alum | .057 | .009 | .015 | .051 | .370 |
| April— | | | | | | |
| 1 | Alum | .096 | .147 | .250 | .285 | .327 |
| 7 | Alum | .040 | .095 | .350 | .845 | 1.770 |
| 11 | Alum | .272 | .485 | .940 | .630 | 1.200 |
| 13 | Alum | 1.042 | .732 | .674 | 1.310 | 2.570 |
| 14 | Alum | .100 | .753 | 1.410 | 2.740 | 4.555 |
| 14 | Silica and alum | .026 | .164 | .093 | .307 | .595 |
| 15 | Silica and alum | .021 | .027 | .058 | .135 | .448 |
| 18 | Alum | .406 | .591 | 2.550 | 2.620 | 2.060 |
| 18 | Alum | .063 | .209 | .429 | .960 | 1.130 |
| 19 | Silica and alum | .003 | .004 | .011 | .014 | .051 |
| 21 | Silica and alum | .006 | .019 | .006 | .016 | .110 |
| 22 | Silica and alum | .006 | .011 | .007 | .026 | .164 |
| 25 | Alum | .046 | .131 | .277 | .710 | .940 |
| 26 | Alum | .032 | .032 | .172 | .202 | .715 |
| 27 | Silica and alum | .013 | .009 | .027 | .060 | .034 |
| 29 | Silica and alum | .003 | .003 | .004 | .006 | .009 |
| May— | | | | | | |
| 2 | Alum | .039 | .042 | .104 | .426 | .378 |
| 3 | "Ferrisul" | .027 | .087 | .120 | .434 | .429 |
| 5 | "Ferrisul" | .069 | .056 | .115 | .912 | 1.023 |
| 6 | "Ferrisul" | .059 | .063 | .097 | .213 | .420 |
| 7 | "Ferrisul" | .064 | .074 | .120 | .798 | .908 |
| 11 | "Ferrisul" | .013 | .028 | .072 | .096 | .275 |
| 12 | "Ferrisul" | .126 | .116 | .133 | .609 | 1.305 |
| 13 | "Ferrisul" | .042 | .041 | .087 | .248 | .830 |
| 17 | "Ferrisul" | .046 | .153 | .165 | .677 | .656 |
| 18 | "Ferrisul" | .061 | .071 | .056 | .148 | .514 |
| 19 | "Ferrisul" | .144 | .083 | .215 | .423 | .370 |
| 20 | "Ferrisul" and lime | .048 | .040 | .050 | .078 | .482 |
| 25 | "Ferrisul" and lime | .034 | .033 | .018 | .163 | .625 |
| 26 | "Ferrisul" and lime | .041 | .051 | .058 | .425 | 1.323 |
| 27 | "Ferrisul" and lime | .022 | .029 | .038 | .092 | 1.070 |
| June— | | | | | | |
| 2 | Ferrous sulfate and lime | .035 | *.050 | .085 | .156 | 1.440 |
| 8 | Ferrous sulfate and lime | .120 | *.058 | .079 | .132 | .472 |
| 9 | Ferrous sulfate and lime | .138 | *.038 | .210 | .637 | .800 |
| 10 | Ferrous sulfate and lime | .139 | *.126 | .134 | .113 | .498 |
| 13 | Ferrous sulfate and lime | .145 | *.121 | .162 | .133 | 1.090 |
| 15 | Alum | .056 | .060 | .067 | .079 | .080 |
| 20 | Alum, lime, silica | .037 | .114 | .060 | .062 | .068 |
| 21 | Silica and alum | .019 | .020 | .025 | .028 | .022 |
| 22 | Silica and alum | .003 | .010 | .023 | .034 | .148 |
| 23 | Alum | .017 | .038 | .034 | .044 | .049 |
| 28 | Alum | .047 | .031 | .041 | .045 | .476 |
| 29 | Alum | .034 | .031 | .068 | .061 | .673 |
| 30 | Alum | .049 | .012 | .029 | .053 | .087 |
| July— | | | | | | |
| 4 | Alum | .027 | .017 | .048 | .090 | .600 |
| 5 | Alum | .029 | .023 | .032 | .021 | .326 |
| 6 | Alum | .018 | .016 | .026 | .039 | .056 |
| 7 | Alum | .045 | .039 | .037 | .048 | .107 |
| 13 | Alum | .046 | .124 | .118 | .164 | .254 |
| Average all tests | | .212 | .225 | .332 | .618 | 1.129 |
| Average of tests using silica and alum | | .017 | .027 | .028 | .067 | .209 |

*Most of the water going to this filter was treated with aluminum sulfate.
†Filter No. 10 contained Anthrafilt.




*Effect of Size of Sand on Coagulated Material Passing Filters*

believed to be due largely to some unaccounted-for disturbance to the filter, though some of it may be due to laboratory errors in burning and weighing the ash. The tests on March 9 and 11 for filter No. 11 are an illustration. Surely Filter No. 11 did not actually pass more suspended matter on March 9th than did filter No. 5. The ash determinations on March 9th for filter No. 11 and April 14th for filter No. 10 were omitted from the averages for silica-treated water given in Table 2.

Consideration has been given to the amount of coagulated matter which may be left in water without affecting its quality. The writer believes that the ash of the coagulated material, found after burning the cotton plugs, should average not more than 0.025 p.p.m. The water from filter No. 11, with sand slightly coarser than that generally used, fell far short of this standard most of the time during the course of the experiments when a coagulant only was used in the treatment of the water. Part of this is caused by the high rate of filtration. This standard probably would not have been attained with sand of 0.5 mm. effective size and a filtration rate of 2 gallons per sq. ft. per min. during the periods of weak coagulation. The 0.025 p.p.m. ash is an arbitrary figure, and it may not be found practical to construct such highly efficient filters, unless the filter is aided by treatments of the water which strengthen the coagulation, such as does the acid-treated sodium silicate.

Tests covering a period of 6 months clearly demonstrate the superiority of coagulating the water with acid-treated sodium silicate and aluminum sulfate. The tests also demonstrate the advantage of using cotton plug filters for comparing filter efficiency.

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## BETTER INSPECTION OF COATED PIPES AT LOWER COST

By G. F. MAUGHMER

*General Electric Company, Los Angeles*

SOME ancient philosophers believed that they saw with the aid of long invisible tentacles which shot forth from their eyes and caressed the surface of the object at which they looked. Reminiscent of this ancient tentacular theory of seeing is the modern method of measuring the bituminous coating and lining thickness on steel pipe. Today, through a new device incorporating the enamel-thickness gauge developed by the General Electric Company, silent, invisible fingers of magnetic flux go groping through enamel films on steel or cast-iron water pipes and report back the thickness of the film with accuracies of one-thousandth of an inch. Here is a paradox for the mechanic of a decade ago. Micrometer accuracy in measuring the thickness of a sheet of material when only one side of it can be physically reached or seen.

Mr. Harry Hayes in the Field Engineering Laboratories of the Water Department of the City of Los Angeles is responsible for suggesting the use of the electro-magnetic thickness gauge in measuring the thickness of enamel coatings on steel water pipe. Confronted with the problem of inspecting some 13,000 feet of 24- and 36-inch enameled steel pipe during the processes of manufacture, Mr. Hayes did some thinking. For instance, he calculated that each 30-foot section of 36-inch pipe represented some 570 square feet of surface counting both inside and outside area. His specifications called for a thickness of coating between the limits of 100 to 150 mills inside and 80 to 120 mills outside. His job was to see that every square foot of pipe produced was coated and lined to these tolerances.

*Mr. Hayes and the Electro-Magnetic Gauge for Measuring the Thickness of Pipe Coatings and Linings*

Mr. Hayes considered the conventional method of stripping and micrometering samples of enamel at random. He did not like the idea. It would prove the thickness of only the actual sample taken, possibly one square inch. The number of samples which could be taken from each section of pipe was limited. At best only a few square inches of enamel could be checked on a section of pipe involving as much as 570 square feet or 82,000 square inches. Then each sample taken meant a patch and the whole process was slow and costly.

Mr. Hayes sought a better way. In a technical magazine he noticed an article about the electromagnetic thickness gauge. This instrument had been developed for the purpose of measuring enamel thickness without destroying such coatings on refrigerator cabinets. It was a far cry from a glistening white enamel refrigerator cabinet to a 36-inch steel pipe coated with black coal tar enamel, but with his imagination Mr. Hayes spanned the gap. And, so, action followed imagination. A thickness gauge was adjusted to meet this problem and with it the Los Angeles City inspectors have done a better job, more quickly, accurately and easily. It has been possible to measure almost continuously the enamel thickness of each section of pipe. As the newly enameled pipe rotates in the special enameling centers the inspector walks slowly along the pipe holding the sensitive "head" against the rotating pipe and the instrument in his hand gives him a continuous indication of enamel thickness.

And so, through the inquisitiveness of Mr. Hayes, it is now possible to literally take thousands of readings of the enamel thickness on every pipe section, without destroying the film or wasting time. Through this close and accurate method of measurement the fabricator has been able to improve his technique and produce a more uniform coating and the City of Los Angeles has been able to do a better inspecting job for less cost.

# FIRST ACTIVATED SLUDGE PLANT IN LOUISIANA

## *Tapered Aeration at Lake Charles Will Provide Treatment for Triple Present Flow*

By J. M. FOURMY
*Consulting Engineer,*
*Hammond, Louisiana.*

A MODERN activated sludge plant, designed to operate on the tapered aeration principle, and equipped with swing type diffusers is being built for the city of Lake Charles, with P.W.A. assistance. It represents the first activated sludge plant to be built in Louisiana.

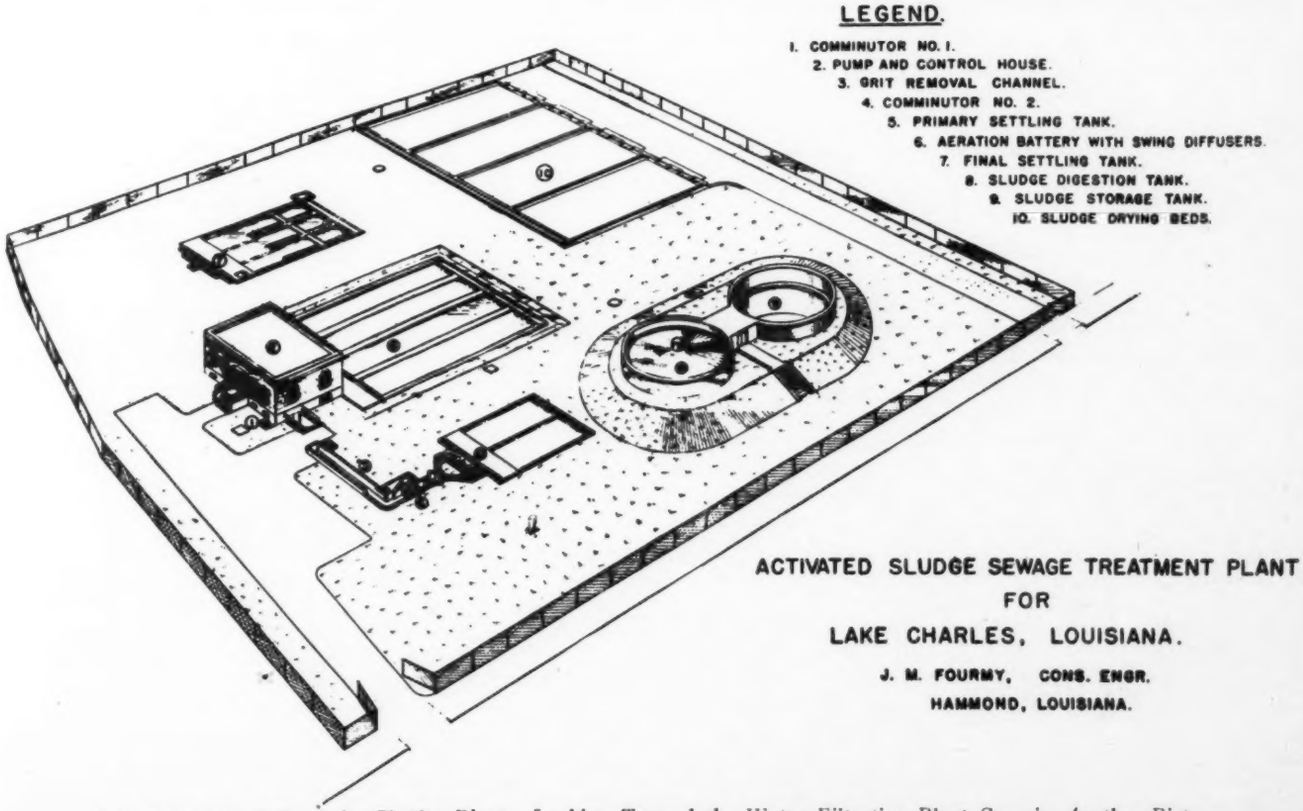
Lake Charles, in southwestern Louisiana, is approximately 250 miles west of New Orleans and 40 miles from the Gulf of Mexico. The city has approximately 12,000 population and is located on the eastern shore of Lake Charles, formed by the Calcasieu River. The present sewer system handles approximately 900,000 gals. per day of sanitary sewage, which is discharged into the lake, following treatment in septic tanks.

In 1933, the need for sewage treatment to eliminate pollution of the lake was called to the attention of the Lake Charles officials by J. H. O'Neill, State Sanitary Engineer. Preliminary plans, based on an Imhoff tank trickling filter plant were prepared and an application was filed for P.W.A. assistance.

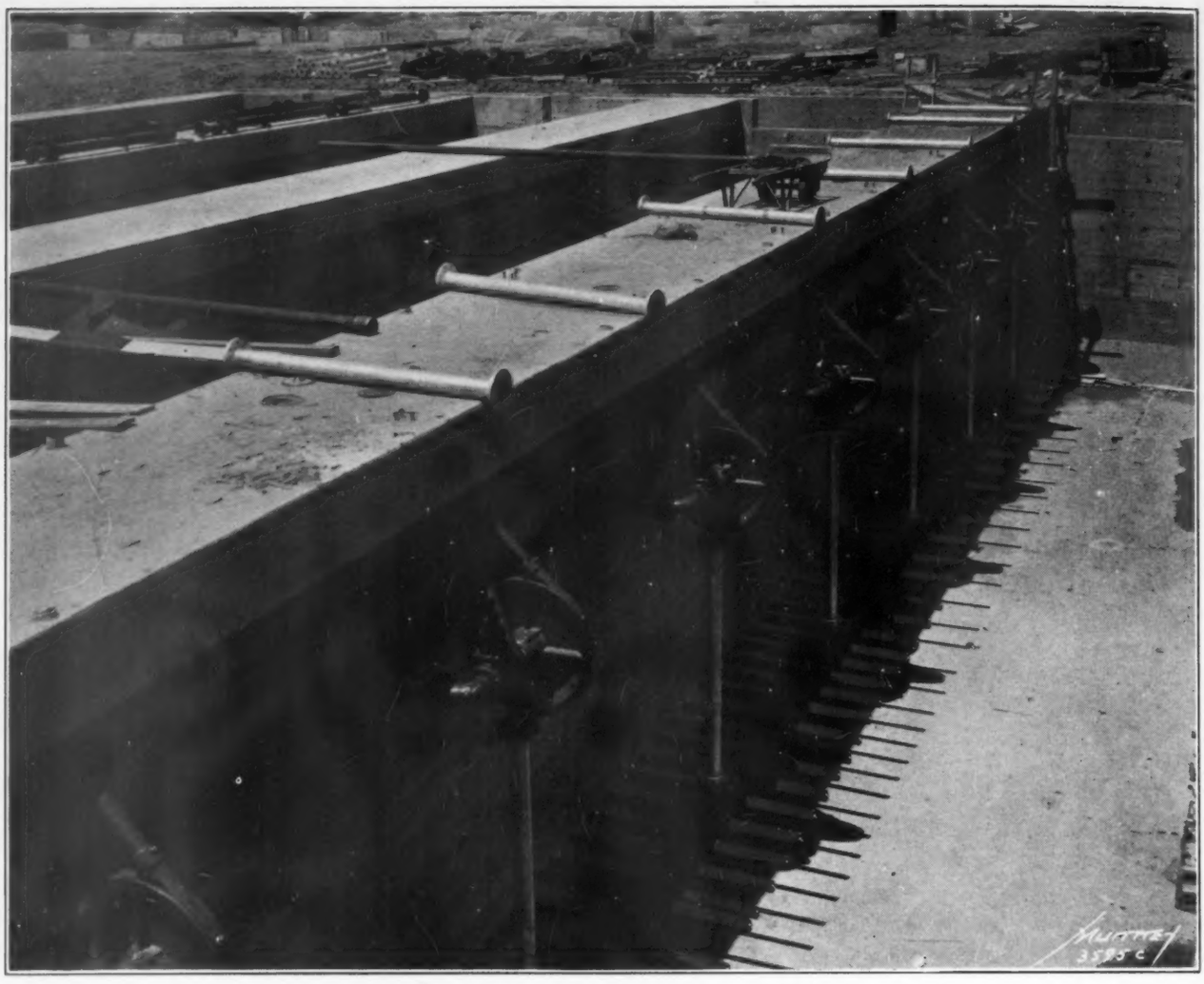
Between 1933 and 1937, Lake Charles became the center of the newly developed southwestern Louisiana oil fields; received governmental assistance for development of the existing Gulf port; and plants for the Swift Company and the Mathieson Alkali Company were constructed just outside the city limits. Taking the history of the trend of commercial and industrial expansion of similarly situated cities in this part of the country, a population of approximately 30,000 for Lake Charles by 1942 is indicated.

Early in 1937 a review of the sewage treatment situation resulted in the decision to design for a larger population than was originally estimated. At the same time it was decided to obtain the highest degree of purification feasible from such a plant. However, the funds available from the original bond issue made it mandatory to procure a relatively low per unit construction cost if complete treatment was to be provided in a plant of greater capacity. Later, an additional $45,000 was made available by obtaining the maximum P.W.A. grant of 45%.

Studies of various processes and types of plant, adaptable in the Lake Charles situation, showed that




*Artist's Sketch of the Lake Charles Plant. Looking Toward the Water Filtration Plant Seen in Another Picture.*



*One of the Aeration Tanks Showing Swing Diffusers in Operating Position*

an activated sludge plant could be constructed for an estimated $175,000.

In January, 1938, a contract for the construction of this plant was let for $179,765.

*Basis of Design—*

| | Present | Design |
|---|---|---|
| Population | 12,000 | 15,000 |
| Average Flow | 0.9 m.g.d. | 1.1 m.g.d. |

Capacity of plant for complete treatment = 2.7 m.g.d. (Equivalent to 30,000 population at 90 gallons per capita per day.)

Design Sewage Strength = 350 p.p.m. 5-day B. O. D.

## Design Features

*Pumping Station*:—The wet well is adjacent to the Control Building, which houses the pumps and office.

A 25-inch Chicago Comminutor, for converting the coarse material in the sewage to small settleable solids, is located in the wet well. Through it passes the sewage from the interceptor to the well.

Four pedestal mounted, Chicago Non-Clog Centrifugal Sewage Pumps, of vertical design, are located in the basement of the Control Building. These pumps have capacities for rates of flow varying from .6 m.g.d., with one pump operating, to approximately 6 m.g.d., with all pumps in operation. The characteristics of the pumps selected are such as to cause the pumps to "ride on the sewage flow." The pumps will operate against a head of approximately 15 feet.

The smallest pump, which will be in practically continuous operation, is located at the far end of the wet well to maintain a continual scouring action, with the aim of preventing deposition of solids.

*Grit Channel*:— The pumps discharge into a concrete channel equipped with a grit collecting mechanism. A proportional weir at the end of the grit channel will control the velocity to approximately 1 foot per second. A vitrified tile bypass, direct to the primary settling tanks, is provided around the grit channel.

Comminutor No. 2 is located in the downstream end of the grit channel as a standby unit, and also to provide comminution for a projected future gravity sewer to the plant.

*Primary Settling Tanks*:—Two rectangular primary settling tanks, with sludge conveying mechanisms, provide 1.8 hours detention at the design flow of 1.1 m.g.d. and 0.75 hours detention at 2.7 m.g.d. flows.

These settling tanks have a common wall and are arranged for operation of one or two tanks. Provision is made for a visible and controlled sludge discharge by a horizontal swing pipe from the sludge hoppers to a sludge collecting well adjacent to the tanks.

*Aeration Battery*:—The aeration battery was designed to make use of the new Chicago Swing Diffuser equipment, arranged so as to provide tapered aeration. Swing Diffusers were chosen primarily because of the accessibility of the diffusers proper from the tank walks, for cleaning or replacements, and for regulation of air

supply. The spacing of the diffuser tubes is based on the design flow and sewage strength, with ample capacity for future maximum conditions.

There are four tanks which are subject to operation in series or parallel. The battery has the following detention periods and oxygenation capacity, the assumption being a raw sewage of 350 five-day B.O.D value.

2 tanks—4 hours @ 1 mgd. net flow.
3 tanks—6 hours @ 1 mgd. net flow.
4 tanks—6 hours @ 1.33 mgd. net flow.
4 tanks—4 hours @ 2 mgd. net flow.
4 tanks—3 hours @ 2.7 mgd. net flow.

(Net flows do not include 20% return sludge which is included in detention periods.)

Re-aeration of the activated sludge may be accomplished by means of channels and the adjustment of gates and weirs. For this condition the sludge may be re-aerated in the initial half or all of tank No. 1.

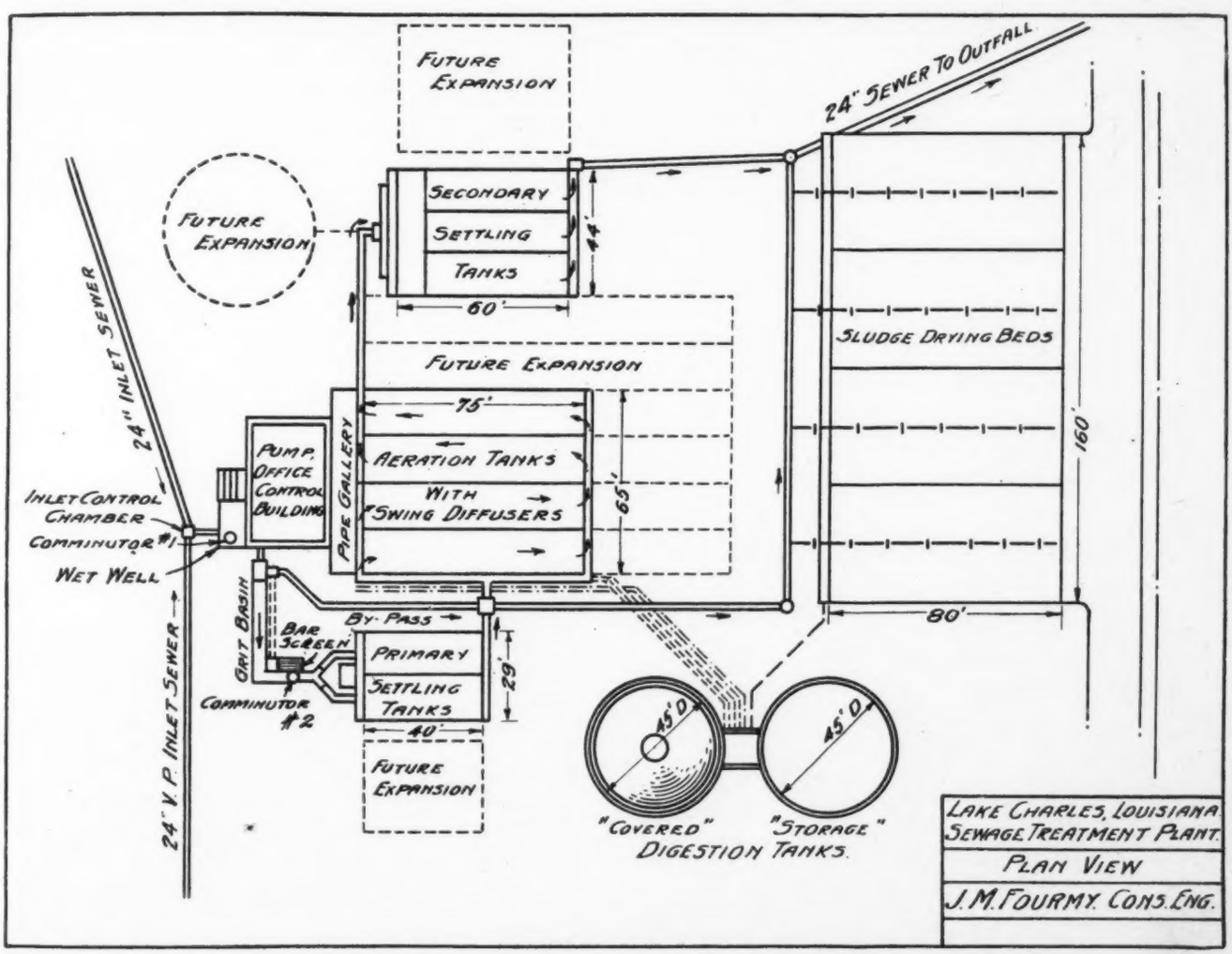
Pre-aeration of the settled sewage may be accomplished by passing the sewage into tank No. 1 and introducing the return activated sludge at the mid-point or at the end of this tank.

*Final Settling Tanks*:—There are three rectangular final settling tanks, equipped with sludge and cross collecting conveying equipment. The design rate of settlement is 750 gallons per day per square foot of available tank area, at an average flow of 1.9 mgd. Each tank has approximately 1.5 hours detention at the design flow of 1.1 mgd.; two tanks have 3.0 hours detention at 1.1 mgd.; three tanks have 4.5 hours detention at 1.1 mgd. The three tanks have approximately a two-hour detention period at plant capacity or 2.7 mgd.

Conventional H-troughs are used to collect the clarified effluent.

Any tank can be cut out of service by merely raising the outlet weir, thus concentrating the flow over the remaining outlet weirs. The tank, or tanks, out of use may be kept in a fresh condition by running the sludge conveyors for those tanks, thus collecting all solids that may settle out of the quiescent liquid.

*Sludge Digestion*:—One floating-cover type and one open-type digester are used. The open digester is designed so that a floating cover may be added when conditions warrant. The digesters are constructed above ground, only going into the ground for a proper foundation. Heating coils are provided for both digesters and gas collection is included in the floating cover unit. The digesters are designed on the basis of 15,000 population, at 4 cubic feet per capita, affording capacity for 30,000 population at 2 cubic feet per capita. Space is allowed in the pump house for a sludge dewatering unit, to be added in the future, when the connected population load is great enough to materially overload the digesters. At that time, a sludge dewaterer may be used to partially dewater the sludge to increase the effectiveness of the digester capacity and reduce supernatant liquor.




*General Plan of the Lake Charles Activated Sludge Plant*

*One of the Swing Diffusers. (This one in position for inspection or changing the spacing of diffuser tubes to secure maximum operating economy which comes through tapered aeration.)*

*Sludge Drying Beds*:—The four sludge drying beds provide one square foot per capita drying surface on the basis of the present population.

*Utilization of Gas*:—The sludge gas will be collected and utilized to operate a 40 hp. gas engine for the blowers and for heating the digester by the circulation of hot water. Mixing valves and gas regulation equipment are provided with the gas engine in case it should ever be necessary to draw additional gas required by the engine from the lines of the local utility. The utility gas has a BTU rating of approximately 1100, and will be used to make up the deficiencies in the output of the digester gas and also as a standby supply. The gas lines from the digester are equipped with standard drip traps, flame traps, pressure relief and waste gas burner and metering equipment.

*Air Blowers*:—The selection of air blowers was based on providing one blower with ample capacity for the present average and maximum flows. This blower is rated at 1200 c.f.m. and is driven by the gas engine. Two additional blowers of 400 and 560 c.f.m., driven by electric motors, were selected as standby units for present operation and to provide additional capacity up to the maximum capacity of the aeration battery.

*Sludge Pumping*:—The primary sludge will be pumped with Scru-Peller Sludge Pumps equipped with Vari-drives. Settled activated sludge will be pumped by horizontal Centrifugal Non-Clog Pumps. also equipped with Vari-drives, discharging into an activated sludge division box for distribution to the aeration battery and to the wet well.

*Miscellaneous Control*:—The pumped sewage will be metered by an electric flow meter, employing an eccentric orifice as the primary element. This orifice will be located in a box just outside of the pump house. The meter will have indicating, integrating and recording apparatus.

*Manometers*:—Provision has been made to regulate the distribution of air, from the main line to the laterals, by valves and orifice-manometers. The orifices for these manometers are of special design, giving a low head loss characteristic not exceeding 3 inches of water at the maximum rate of air flow.

*Laboratory*:—Allowance has been made in the contract for outfitting a complete laboratory for the making tests, in accordance with A.P.H.A. Standard Methods.

An Odeeometer has been included in the laboratory equipment to afford "spot" determinations of rates of oxygen utilization and oxygen input requirements at various sections in the aeration tank. Such tests will be valuable for quick check-ups, to determine the condition and activity of the activated sludge.

The Odeeometer will serve to correlate the activity of the sludge, as measured by its oxygen utilization rate and arithmetical concentration, so a relationship may be established between the two for regulation of the process.

*Service Guarantees*:— The Sewer Board showed laudable business sagacity in recognizing that plans for a completely modern and mechanically equipped sewage treatment plan for Lake Charles, must also include adequate provision for its effective operation and maintenance. Accordingly, the Board appointed Mr. S. S. Crawford, Superintendent of the Sewer Board, and electrical engineer for the city, as Chief Operator for the plant.

The Sewer Board also stipulated that the specifications for the mechanical equipment call for the services of a competent sanitary-engineer, from the company supplying the air diffusion equipment, to supervise initial operation and regulation of the plant, and to fully train the operator in maintenance, operation and testing. This service was required for an initial period of thirty days, and, thereafter, quarterly inspection trips during the first year for checking the plant and further training the operator.

The rapid progress being made in construction, due to the well rounded organization of the general contractor and the almost complete absence of any ground water in the excavation, will make it possible for this plant to be in operation in the early Fall.

The author wishes to express his appreciation for the whole-hearted co-operation of the P.W.A. officials in Ft. Worth, Texas, and Washington, D. C., directly and indirectly connected with this project.

*Across the Corner of the Aeration Units Is One of the Two Stage Digestion Tanks—See Artist's Sketch. (The plant is literally in the backyard of Lake Charles Water Purification Plant, showing in center background.)*

# ELECTRIC POWER DERIVED FROM REFUSE INCINERATION

By JOHN BERGDOLL,*
*Engineer, New York, City*

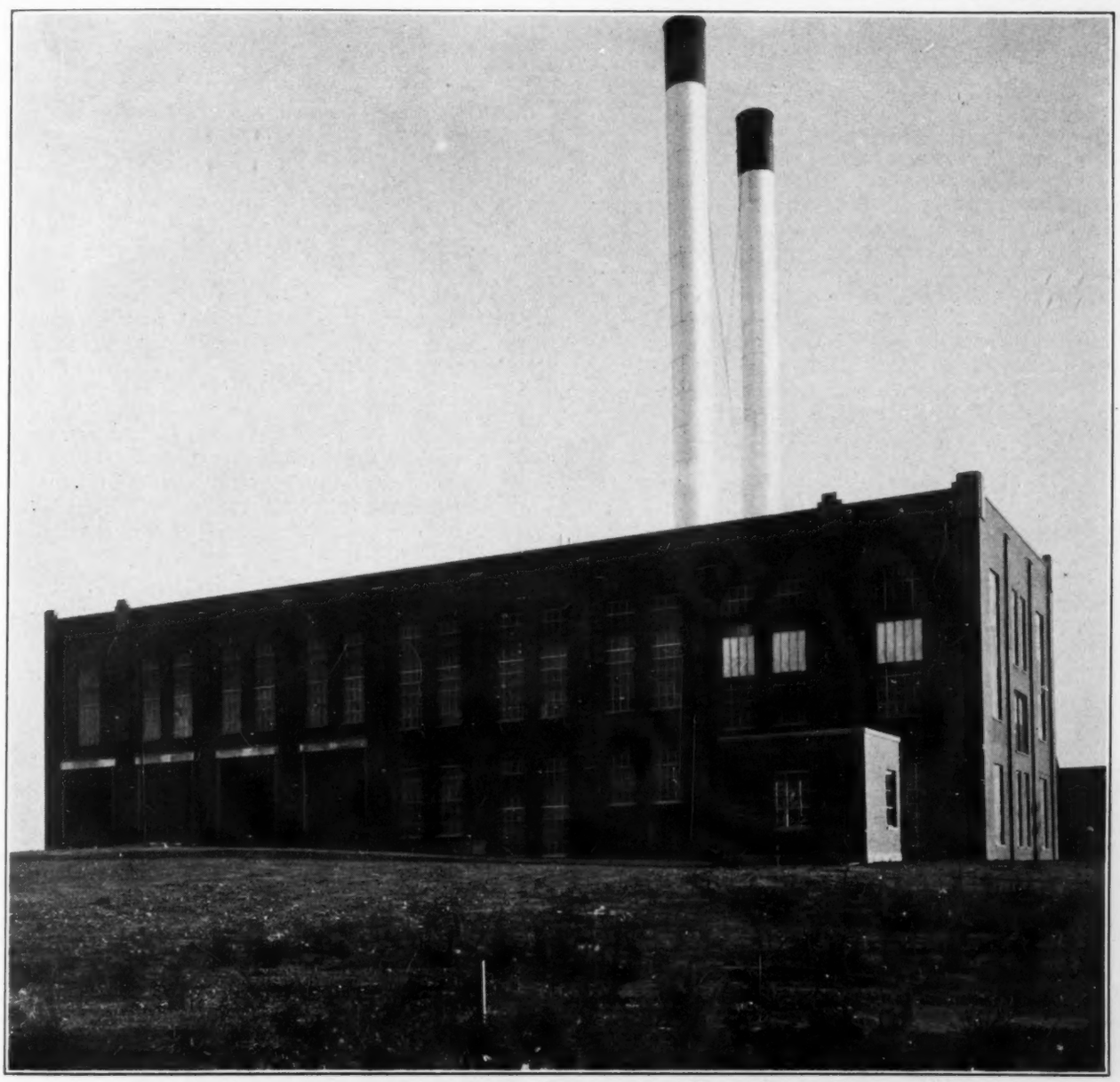
ALTHOUGH it is the writer's intention to confine the subject matter of this paper largely to information regarding the design, operation and performance of power-generating incinerator plants, it may be well to outline very briefly certain circumstances preceding the advent of the modern high temperature power-generating incinerator.

## Some History

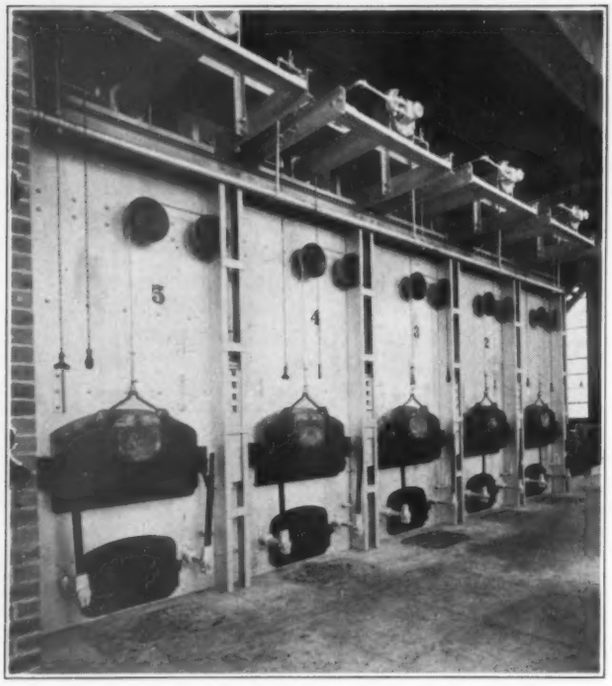
The early incinerator plants erected in the United States, during the period from about 1885 to 1905, were almost without exception designed to dispose of garbage only. Most of the incinerators constructed during this period were soon abandoned because of the nuisance due to smoke and odors, the continuous fuel expense and difficulties of maintenance.

In the meantime, some designers and municipal officials began to recognize the superiority of English incinerator designs and practices; and, during the period from 1906 to 1913 about a dozen incinerator plants were erected in the United States and Canada which were virtually direct copies of then existing English prototypes. Most

*The author, now Eastern Representative of the Garfield Fire Clay Co., was formerly Incineration Engr. of the Koppers Co. and Chief Engr. of Hiler Engineering and Construction Co.



*The Providence Incinerator—Which Supplies Power to the Adjacent Sewage Treatment Works*



*The Five-Cell Incinerator Furnace of Providence*

of these plants were intended to incinerate a mixture of garbage, rubbish and ashes and the furnaces were liberally equipped with mechanical appurtenances. These plants, while not ideal according to present standards, were marked improvements over previous American types. They operated without use of auxiliary fuel and at such comparatively high temperatures that the smoke and odor nuisances were greatly diminished and at the same time waste heat gases were at sufficient temperatures and volume to make feasible the generation of steam for plant and outside use. However, these plants had certain inherent faults which ultimately interfered with continued promotion of the power generating type of incinerator.

As a general rule, most of the incinerator plants built during the last twenty-five years might be classed as high temperature destructors, burning combustible wastes with little or no auxiliary fuel added, and developing waste gas temperatures ranging from about 1,000 deg. F. to 2,700 deg. F. in the gas combustion chambers. Temperatures read at the base of the chimneys would run from about 600 deg. F. to 1,800 deg. F. depending on plant type and design.

### Why the Lag in Power Production?

Despite the fact that the incinerator waste gas temperature range was ideally suited to steam production, power generating incinerators were the exception rather than the rule. Aside from municipal inertia, the greatest obstacle to the utilization of incinerator waste heat has been the protective franchises granted to the privately owned public utility companies. Such a franchise usually prevents the municipality from selling competitively any power it might develop in any municipal plant. The municipality may use such power for municipal purposes but in so doing is usually denied the right to cross the utility's distribution system, which is located throughout the public streets.

Hospitals, schools, municipal buildings, garages, water pumping stations, sewage pumping stations, water purification plants, sewage treatment plants, street lighting systems, asphalt preparation plants, poor farms, and many other municipally controlled activities are all potential users of the light, heat, and power which can be developed by the local refuse incinerator plant. However, the usual case is to find the incinerator plant located so far away from any of these potential users that the transmission problem is impossible, due to the distance and the franchise protection clauses. It is obvious that in many instances a little long-range planning would remedy this difficulty.

Of course, there have been many incinerator plants constructed which do make some use of the waste heat, usually producing steam but not electricity. These plants are designed to produce up to three quarters of a pound of steam per pound of mixed refuse incinerated. The steam is usually used for heating and power in the incinerator and any excess is used to augment the regular heating or power generating equipment in adjacent public buildings. If there is no suitable adjacent user for the excess steam it may be re-condensed or discharged to the atmosphere, either being wasteful. Such plants, while performing a useful purpose, cannot be classed as efficient power generating incinerators inasmuch as they develop only a fraction of the total available fuel value of the mixed refuse.

### The Status Today

It is not intended to infer that all municipal incinerator plants should be power-generating, or that it is always possible to avoid conflict with local franchise, or to find a suitable location for such a plant. However, any city having a population of 50,000 or more could well afford to give the matter serious study. Outstanding examples of municipal power-generating incinerators are, among others: Rochester, N. Y., burning rubbish only, generating 50,000 lbs. of steam per hour for use in the adjoining garbage reduction plant; Atlanta, Ga., burning mixed garbage and rubbish, generating over 25,000 lbs. of steam per hour which the city sells at metered rates direct to the local utility company's adjacent power plant; and Providence, R. I., (the newest) burning mixed garbage and rubbish, generating approximately 20,000 lbs. of steam per hour which is converted into electric power for use in operating the adjacent activated sludge sewage treatment plant. These and several other similar plants demonstrate the practical results of proper planning.

## The Modern Power-Generating Incinerator

The ideal set-up for a power-generating incinerator, like any power plant, is one in which the power output load is fairly constant during the entire 24 hours of each day and during the entire 7 days of each week. Such an operating cycle has two major benefits; it reduces to a minimum the amortization loss on stand-by and idle equipment, and at the same time greatly reduces the refractory maintenance cost per hour of usage. However, while desirable, such uniformity of operation is not essential to the success of the project. This, because the power-generating incinerator, in its own way, is as dependable and suited to load fluctuations and varied operating periods as any regular power plant.

In order to properly evaluate the desirability and feasibility of the power-generating incinerator, we must consider all phases of the problem, including:

(a) Capacity range of practical plant.
(b) Net cost as compared with ordinary incineration.
(c) Dependability as a power generator.
(d) Dependability as a refuse incinerator.
(e) Plant equipment and arrangement.

(f) Flexibility and method of operation.
(g) Use of developed power.

### Capacity Range

It is obvious that the economic desirability of a power-generating incinerator depends entirely on a financial study of the factors of first cost, operating cost, amortization period, finance interest rates, and cash or credit return for the power developed. Such a project might not be financially sound or attractive in a district where materials costs, labor rates and interest rates are unusually high and existing commercial power rates unusually low, but this combination of disadvantageous circumstances is rarely met with in actual practice.

Lacking a complete study of all pertinent local factors, it is impossible to state what is the smallest size plant that would lend itself to practical application. There is no question but that a plant rated at 100 tons of mixed refuse (garbage and rubbish) per 24 hours is entirely practical and economically desirable. Even smaller plants may show an attractive balance sheet for many communities. There is no limit to the size of larger plants, it being a case of "the bigger the better."

In order to provide a common basis for analysis and comparison, it is necessary to assume certain factors as being the general average for all cases. These assumed factors may not be precisely correct for any particular community but nevertheless enable us to arrive at the proper comparative net gain or loss, regardless of whether or not the dollars and cents values are actually correct. We repeat, each and every potential installation must be minutely examined on its own merits, but for purposes of proceeding with our study, we have assumed in all cases that:

(a) The refuse to be incinerated is the average municipal mixture of about 65 per cent garbage and 35 per cent rubbish by weight, having a total moisture content of about 50 per cent by weight, incombustible residue of about 13 per cent, and a calorific value of approximately 3,200 B.t.u. as received at the plant.

(b) The construction costs will be governed by labor rates averaging $13.20 per day for union mechanics. Materials costs based on current prices in the New York and similar markets.

(c) The operating costs will be governed by rates averaging 60 cents per hour for stokers, one dollar per hour for cranemen, foremen, etc., and higher for watch engineers, etc.

(d) Electric current to operate the non-power-generating incinerator plant can be bought for about two cents per KWH.

(e) Excess electric current developed by the power-generating incinerator can be sold for about one and one-half cents per KWH, or credited at that value if used.

With these factors assumed, we can now proceed to study a direct comparison of costs of straight incineration vs. power generation. For the purpose of our example, let us base our study on a mixed refuse collection averaging 300 tons per day, six days per week. For the sake of simplicity, we have disregarded the usual seasonal variations and other variables, since they do not affect the final result.

### Cost—Straight Incineration

The most practical plant to take care of this tonnage and allow some leeway for overload, would be one having a rated capacity of 350 tons per 24 hours, equipped with storage receiving bin and grab bucket crane, and operated during three consecutive 8-hour shifts per day, six days per week. The plant will be equipped with mechanical charging gates and some form of ash tunnel.

We may assume that the plant will cost about $360,000 to furnish and erect, and that the cost will be amortized in 15 years at 2 per cent interest per year on the unpaid balance; in which event the fixed costs will run:

| | |
|---|---|
| Annual Payment on Principal | $24,000 |
| Annual Average Interest | 3,840 |
| Annual Fixed Charges | $27,840 |

The main items comprising actual daily operating and maintenance costs for this plant would run about as follows:

| | Per day |
|---|---|
| Wages for foremen, cranemen, feeders, stokers, mechanics, utility and ashmen | $160 |
| Electric Light and Power | 30 |
| Maintenance, repairs, lubrication | 18 |
| Total Direct Costs | $208 |
| Total Direct Costs, 312 days, per year | $64,896 |

On the basis of 300 tons per day, 312 days per year, which is 93,600 tons per year, the cost sheet of this straight incineration plant would run approximately as follows:

| | Per year | Per ton |
|---|---|---|
| Fixed Charges | $27,840 | $0.30 |
| Direct Costs | 64,896 | 0.70 |
| Total Costs | $92,736 | $1.00 |

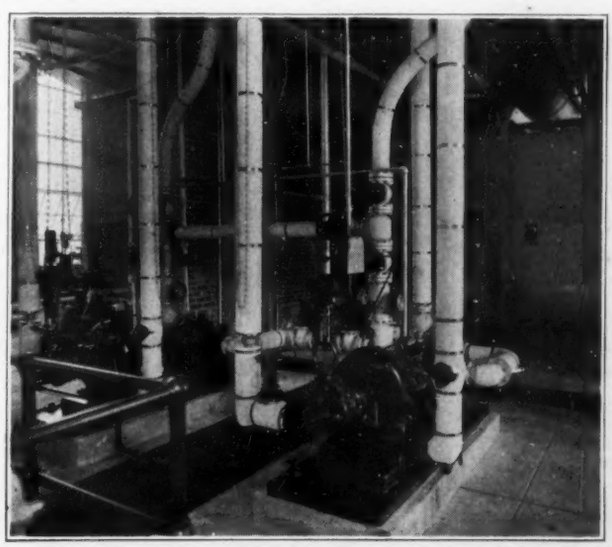
So much for the estimated costs of building and operating a regular non-power-generating incinerator plant.

### Cost—Power Generator

Now, using the same basic factors, let us see the comparative costs for a power-generating incinerator.

Since the proposed power output will probably be required 7 days a week, including holidays, the annual collection of 93,600 tons divided by 365 days indicates an average of 256 tons per day to be incinerated. To allow some overload capacity the plant would be designed for about 300 tons per 24 hours.

We may assume that the complete plant will cost about $840,000 to furnish and erect, that the cost will be amortized in 15 years at 2 per cent interest per year on the unpaid balance; in which event the fixed costs will run:



*The Boiler Room of the Providence Plant, Showing Feed Water Pumps*

| | |
|---|---|
| Annual Payment on Principal | $56,000 |
| Annual Average Interest | 8,960 |
| Annual Fixed Charges | $64,960 |

The main items comprising actual daily operating and maintenance costs for this plant would run about as follows:

| | Per day |
|---|---|
| Wages for foremen, cranemen, feeders, stokers, mechanics, helpers, ashmen, watch engineers, electricians, etc | $280 |
| Maintenance, repairs, lubrication | 35 |
| Total Direct Costs | $315 |
| Total Direct Costs, 365 days, per year | $133,225 |

On the established basis of 256 tons per day, 365 days per year, which is 93,600 tons per year, (the same as for the regular incinerator) the cost sheet of this power generating incinerator plant would run approximately as follows:

| | Per year | Per ton |
|---|---|---|
| Fixed Charges | $ 64,960 | $0.69 |
| Direct Costs | 133,225 | 1.42 |
| Total Costs | $198,185 | $2.11 |

These cost figures do not take into account the net return from sale of the electric energy output. At its average burning rate of 256 tons per day, the power generator will develop about 2,000 KWH per hour, 90 per cent of which is available for outside use. On this basis the plant has available for outside sale 1,800 KWH per hour or 43,200 KWH per 24 hour day. At $0.015 per KWH, the use or sale of this current would return $648 per day which is equivalent to a gross of $236,520 per year.

Therefore the cost balance sheet of this power generating incinerator plant would look about as follows:

| | Per year | Per ton |
|---|---|---|
| Return from sale of current | $236,520 | $2.52 |
| Total Costs | 198,185 | 2.11 |
| Net Profit | $ 38,335 | $0.41 |

In other words, any community erecting a regular incinerator plant under the conditions outlined above would have to spend in the neighborhood of $93,000 each year to build and operate the plant, which is equivalent to a direct loss of $1.00 for each ton burned.

On the other hand, if the same community erected a power-generating incinerator plant and sold or used the excess energy as outlined above, the sale of the current or the credit for its use would not only pay the entire cost of amortizing and operating the disposal plant but would actually yield a profit of about $0.41, instead of a deficit of $1.00, for each ton burned.

As stated before, each potential application must be carefully studied on its own merits, but the hypothetical example outlined herein is a typical example indicating that self-supporting disposal plants are not an idle dream.

So much for the economics of the problem.

### Dependability

Let us now give consideration to the dependability of the power generating incinerator. Waste heat boilers and steam driven turbo-generators are so familiar and dependable that we need not waste words describing their method of performance. Admittedly, if the waste heat boilers receive the necessary volume of hot gases at the required temperatures, sufficient steam will be produced to operate the generators at rated capacity. Therefore the incinerator furnace must be considered as the prime mover of the entire performance and its design must be governed accordingly.

For the present, we will assume that our plant is correctly designed in all its component parts and consider only its dependability. Based on actual performance of existing power-generating incinerator plants, and without benefit of conjecture regarding future improvements, we can safely guarantee that the hypothetical plant we have chosen as a typical example will, when operating at its average capacity of 256 tons per 24 hours, perform as outlined below:

(a) It will properly and uniformly incinerate its rated capacity of mixed refuse without regard to the fluctuations of the power output load.

(b) The hot gases leaving the incinerator furnaces and entering the waste heat boilers can be held within a fluctuation range of 200 deg. F., without use of any fuel, as long as there is refuse available to burn. That is to say, this temperature may range between a low of 1,800 deg. F. and a high of 2,000 deg. F. continuously for days without the usual undue temperature drop due to ash removal, refuse feeding and similar causes.

(c) The steam boilers will produce 48,000 pounds of steam per hour at, let us say, 200 pounds pressure and 100 deg. F. superheat. This is equivalent to 2.25 pounds of steam per pound of mixed garbage and rubbish burned.

(d) Steam pressure will not fluctuate beyond a range of 10 pounds over or under the desired mean throughout a 24-hour day, despite the usual inconsistency of municipal refuse as fuel.

(e) The turbo-generators will develop a consistent output of 2,000 KWH per hour at 2,400 volts. Less than 10 per cent of this output will be required for station operation, the remainder being available for outside usages, transformed to desired voltages.

(f) The waste gases emitted from the chimneys will be inoffensive.

(g) The incinerator residue will be well burned innocuous ash and clinker.

(h) No auxiliary commercial fuel will be required as long as there is sufficient refuse available to burn at rated capacity.

### Plant Equipment

Now let us give some thought to the major items of plant equipment which would be required for the 300-ton per 24-hour capacity plant which we have chosen as an example. There are several practical arrangements, any one of which will do the job properly, for instance:

*Arrangement No.* 1

Two—Incinerator Furnaces, each 150 tons per 24 hours.

Three—Waste Heat Boilers, each 700 B.H.P.

Three—Turbo-Generators, each 1,250 KW per hour.

This arrangement, when operating at rated capacity, requires two furnaces, two boilers, and two generators to be in continuous service. It does not provide a spare stand-by furnace but does provide a spare boiler and a spare generator. The incinerator furnace is not subject to the sudden mechanical failure which might befall the boilers or generators, and is also easier to repair. It

can be reconditioned during the seasonal periods of light refuse collections. Therefore, a spare incinerator furnace, while nice to have in the plant, can be dispensed with if its extra cost affects the balance sheet adversely. This is the cheapest dependable arrangement, and the large furnace size is more efficient than a smaller size.

*Arrangement No. 2*

Would be the same as No. 1 except provide one extra 150-ton capacity incinerator furnace for stand-by service.

*Arrangement No. 3*

Three—Incinerator Furnaces, each 100 tons per 24 hours.

Four—Waste Heat Boilers, each 470 B.H.P.

Four—Turbo-Generators, each 850 KW per hour.

This arrangement, when operating at rated capacity, requires three furnaces, three boilers, and three generators to be in continuous service. It does not provide a spare stand-by furnace but does provide a spare boiler and generator. It has superior flexibility due to the greater number of operating units but, each unit being smaller, it is not quite the equal to arrangements No. 1 and 2 as far as moisture evaporation and sustained high heat development is concerned, and will cost more to build.

*Arrangement No. 4*

Would be the same as No. 3 except to provide one extra 100-ton capacity incinerator furnace for stand-by furnace.

## Method of Operation

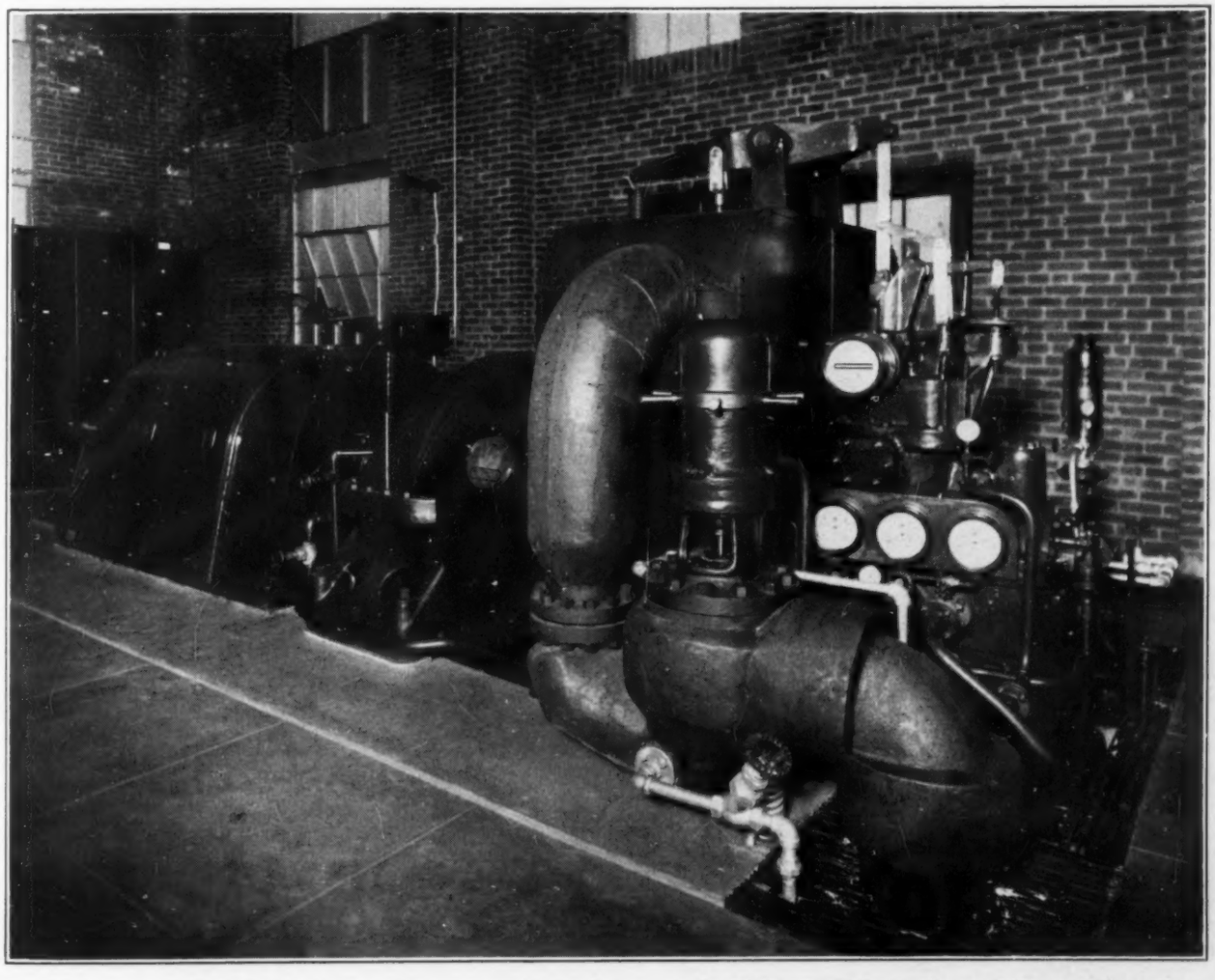
The design of each piece of equipment in the plant could be the subject of a lengthy paper in itself and will not be attempted here. However, if we follow the course of events from the dumping of the collection truck at the plant to the exodus of the electric current at the switchboard, we will probably hit most of the salient points on the way.

The collection trucks should be able to arrive at the plant, dump their loads into a receiving bin and drive away, all without delay or obstruction. The receiving bin should be rather long so that many trucks can be accommodated at one time and the means of entrance and exit should be ample so that a dumping truck does not unduly impede the maneuvering of trucks arriving at or leaving the plant.

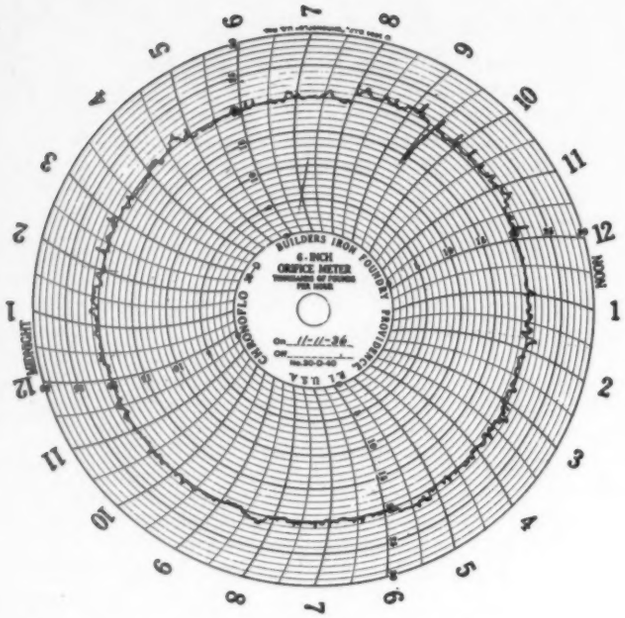
The receiving bin should be ample in size to receive the entire day's collection and provide sufficient excess capacity to store the refuse which is accumulated during the week and burned over the week-end.

The electric overhead crane with grab bucket, for lifting the refuse from the bin to the furnace charging containers, should be ample in speed and horsepower and be ruggedly built for continuous 24-hour service. One crane, fitted with a 1½ cubic yard capacity grab bucket, will handle the refuse fast enough, but a spare stand-by crane is worth considering.

The charging hoppers which receive the refuse from the crane bucket should be large enough to catch the



*One of the 1,250 K.W. Westinghouse Generators of Providence—Which Makes Possible the Slogan, "Waste to Watts."*




*Chronoflo Chart Showing Uniformity of Flow—Typical 24-Hour Period*

bucket load without spillage and arranged to split the load to the several charging containers. These containers, which proportion the charge admitted to each part of the incinerator furnace, should not be too large. About one cubic yard at a time is large enough. A small charge is quickly heated to furnace temperature and ignited. A large charge blankets the fire for a time and causes undue temperature drop.

There should be a sufficient number of charging holes in the roof of the furnace to properly charge all areas of the firebox without undue stoking. Each of these holes should be at least 6 square feet clear opening and be fitted with a fast, powerful cutoff gate operated by the stoker.

The design of the furnace firing chamber is one of the most important items. It should be designed to operate at consistently high temperatures and so arranged that the periodic removal of ashes from the grates will not cause an appreciable drop in temperature. The average gas travel within the furnace itself should be sufficiently lengthy to permit at least part of the gases from combustion to reach a high enough temperature to assist the burning process within the firing chamber. The multiple-cell mutual-assistance high temperature furnace is undoubtedly the best suited for use as a heat developer in a power generating incinerator plant.

The 150-ton furnace mentioned above would be arranged as a long continuous firebox about 8 feet 6 inches deep and 30 feet long inside the firing chamber. The combustion gases would travel all in one direction from point of inception to a bridgewall at one end of the long firing chamber. The furnace would be divided into five separate "cells." Each "cell" would have a separate charging opening, stoking door, dumping grate section, a forced draft control valve and ash pit with hopper.

With this arrangement it is possible to quickly clean one-fifth of the firebox area without interfering with the operation of the other four-fifths. One "cell" is cleaned, recharged, and returned to burning service befor the next "cell" is cleaned. Thus only 20 per cent of the firebox is affected by cleaning operations while the other 80 per cent is operating full blast. Cleaning of any one cell takes less than 10 minutes and need be done only once or twice in each 8-hour shift.

There are many forms of ash tunnels for incinerator use. The most popular form today consists of a separate ash hopper under each furnace "cell" into which the ash falls from the dumping grates. These hoppers are fitted with water sealed gates and are provided with ash quenching sprays. A driveway is provided under each line of ash hoppers and the ash is dropped from the hopper into a removal truck at convenient intervals.

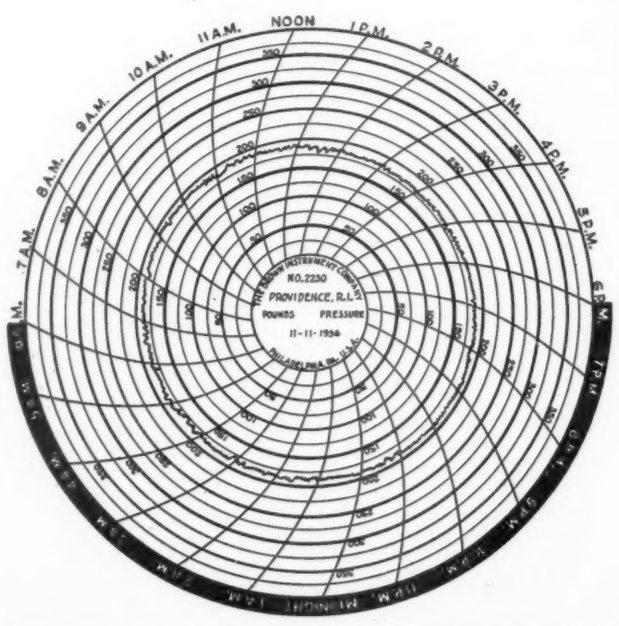
In another type of ash tunnel, the ash gates and quenching sprays are omitted entirely. Instead the open end of each hopper is immersed in a continuous trough filled with water. Thus all of the fine ash falling through the grates, as well as the ash and clinker from cleaning, drops into the water filled trough and is immediately quenched and made dustless. A continuous scraper conveyor carries the ash from the trough to a truck loading storage bin outside the building.

Now to return to the gases leaving the incinerator furnace. These gases, of course, carry a fair amount of entrained dirt, slag particles, and fly ash which must be settled out before the gases enter the boiler tube areas. Ample areas, dust pockets, and baffles must be provided for this purpose and yet these precautions should not cause too great a drop in the gas temperature.

The waste heat boilers should be specially designed for the service, gas velocities throughout the gasways being sufficiently high to discourage slag deposit on the tube surfaces. Superheaters should be provided to insure dry steam at the turbine. Auxiliary oil burners, or other device, should be provided for use when there is no refuse available for fuel. These burners should be amply large to develop full boiler rating.

For maximum efficiency, the generator turbines should be run condensing. Surface type condensers are satisfactory for this service. The effluent water from a nearby sewage treatment plant has been found satisfactory for use as condenser water, and its use will effect a considerable saving in operating costs.

In actual operation, the incinerator plant may be run as a unit in itself. The incineration of refuse may be




*Providence, R. I., Incinerator Chart, Showing Uniformity of Steam Pressure—Typical 24-Hour Period*
*Providence, R. I., Incinerator*

carried on at uniform rates regardless of the operation of the adjoining power generating equipment. The incinerator stoking room should be provided with a large easily visible gauge showing the steam boiler pressure. The incinerator firing room should operate the incinerator furnaces at rates sufficient to maintain the uniform desired steam pressure, without regard to the power output of the turbo-generators. As long as the necessary steam is being produced by the boilers, the turbo engineer can easily meet the fluctuations in power demand by increasing or diminishing the condenser operating vacuum.

### Use of Power

Only a very few of the incinerator plants in this country, which use the waste heat to generate steam, are equipped to generate any electric power at all. The very few that do generate electricity do so in a very small way, the generators being small and, as a rule, the power output being only a fraction of that possible if all the fuel value of the refuse was utilized.

The most notable exception to this rule is the municipal incinerator plant built by the city of Providence, Rhode Island, which has been in continuous operation since August, 1936. This plant has a rated capacity of 160 tons per 24 hours and a power output, at rated capacity, of 1,250 KWH per hour, 90 per cent of which is available for outside use. At present, the power is used to operate the air compressors for the city's activated sludge plant. This treatment plant handles a dry weather average of 36 MGD, although a maximum of 150 MGD has been reached. The sewage plant supplies about 3½ MGD of effluent water to the incinerator power plant condensers. The use of power from the incinerator plant will be increased when the present steam driven sewage pumps are electrified.

Several important trends in the development of waste heat power generation are indicated in the information at hand regarding the operation of the new 56th Street incinerator plant recemly completed by the city of New York. This plant is rated to burn about 1,000 tons per 24 hours and is equipped with two 500 KW generators. Experiments are being made to determine the practicability of operating the refuse collection trucks on storage battery power and charging these batteries from the power generated at the incinerator plant. This plant is designed for future expansion of the steam and electric generating plants.

This paper has treated with the developments of the past and the present, which, while quite meager, indicate that definite practical results have already been attained, and should be greatly surpassed in the near future, in respect to converting "Wastes to Watts."

*Acknowledgment*—This paper was presented by the author before the Sanitation Group of the American Society of Mechanical Engineers. It has been assigned for publication in WATER WORKS AND SEWERAGE.

▼

# A Curious Gas Engine Design

By J. B. MERIAM
*Chief Engineer, The Meriam Company, Cleveland, Ohio*

THE accompanying diagram shows an unusual type of gas engine designed some years ago by a Mr. Humphrey. It has the unique feature of requiring neither pistons, connecting rods, crankshaft nor flywheel. The pumping action is produced by the direct

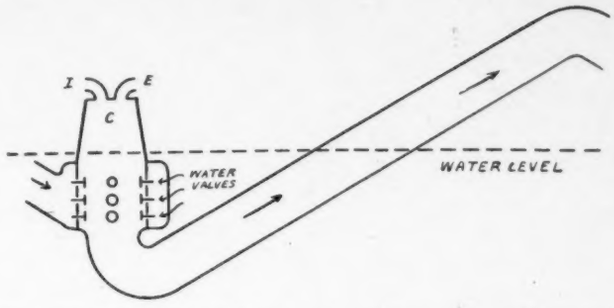



*Diagram of Humphrey Pump (No Pistons, Connecting Rods, Crankshaft, Flywheel, or Cooling System)*

explosion of the gas and air mixture against the surface of the water to be lifted. Unlike so many "freak" designs, the engine proved highly efficient for the purpose for which it was built, and was used by the Metropolitan Water Board, London, England, at its Chingford Pumping Station.

It will be noted that the combustion chamber or "cylinder" C is so located with respect to the suction level that when the engine is not in operation the lower part is filled with water by means of automatic spring-controlled, inwardly-opening valves; the upper part being utilized for the gas and air charge, and provided with suitable intake and exhaust valves (I and E). These valves are so interlocked that the changes in the internal pressure of the cylinder contents compel each valve to open in its proper sequence.

The cycle of operations is similar to that in an ordinary gas-engine—firing stroke, exhaust stroke, charging stroke and compression stroke. One useful point about the engine is that it invariably stops on the compression stroke, and thus the starting up is rendered easy. The weight and momentum of the water itself serves as a flywheel to carry on over the non-firing strokes. On the firing stroke, the pressure of the explosion closes the water valves, and since the gas intakes and exhaust valves are already shut the water in the cylinder and delivery pipe is "kicked" upwards through the rising pipe outlet, about one-third to one-fourth of it being ejected. Since the momentum of the water is considerable, this surge creates a slight vacuum in the engine cylinder, and the exhaust valve opens by its own weight. At the same time, the water valves permit more water to flow into the combustion chamber C. Having exhausted its momentum, the water surges back again into the cylinder, and the burnt gases are expelled. This pressure now operates the interlocking gear and the exhaust valve closes. The next decreasing swing in the delivery pipe water being outwards, the intake valve opens and admits the next charge of gas and air. It then closes as the following back-surge takes place, and the compression stroke completes itself; the cycle then starting to repeat.

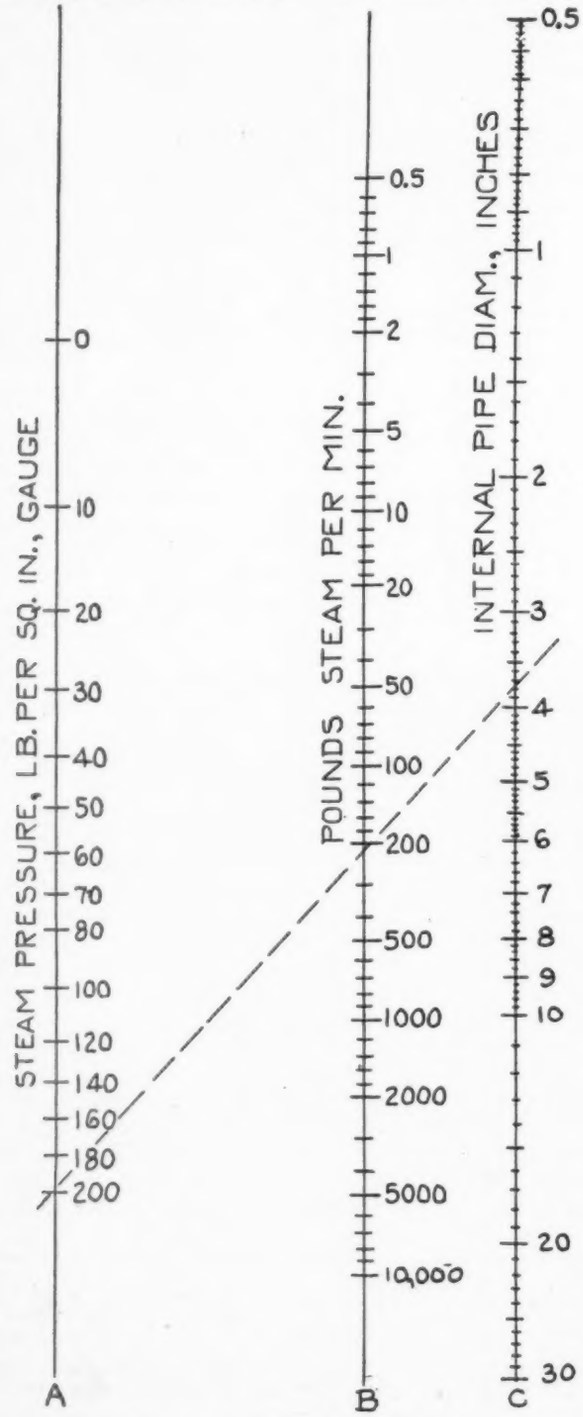
Among the advantages claimed for this peculiar engine are the following: It gives high efficiency—tests indicating that it could handle full load without requiring any more fuel than an ordinary engine of equal horsepower carrying no load at all. There is of course no piston, connecting rod, or crankshaft wear. No water-cooling system is needed; nor is there any possibility of pre-ignition, since the cylinder wells are washed at every stroke. Finally, there are hardly any parts likely to get out of adjustment. However, since the engine appears to be very sensitive to changes of suction level, and since it is not self-priming unless the lower part of the cylinder can be located below the surface of the water to be pumped, its use does not seem to have been a wide one.

## WATER PLANT STEAM PIPE CHART

By W. F. SCHAPHORST, M.E.
*Newark, N. J.*

EVERY water works official knows that many pages have been devoted during recent years to steam charts and formulas, but unfortunately both the charts and formulas have usually been more or less bewildering. The accompanying chart is an effort by the writer to make one as simple as possible. It requires only one operation for the solution of the problem. It is based upon the velocity of steam that is used most, namely, 6,000 feet per minute.

For example, what size steam pipe shall be used where the steam pressure is 200 pounds' gauge and where 225 pounds of steam are to be used per minute? The dotted line across the chart shows how easily it is done. Simply run a straight line through the 200, column A, and the 225, column B. The intersection with column C gives the answer as 3.75 inches internal pipe diameter. This is very close to a 4-inch pipe and therefore a 4-inch pipe should be used.




If the steam pressure is known (column A), and the pipe is already installed, the diameter of course is a known quantity (column C) and the pounds of steam that the pipe will carry per minute is easily determined by simply connecting the known factor in column A with the known factor in column C. The intersection with column B gives the pounds of steam per minute.

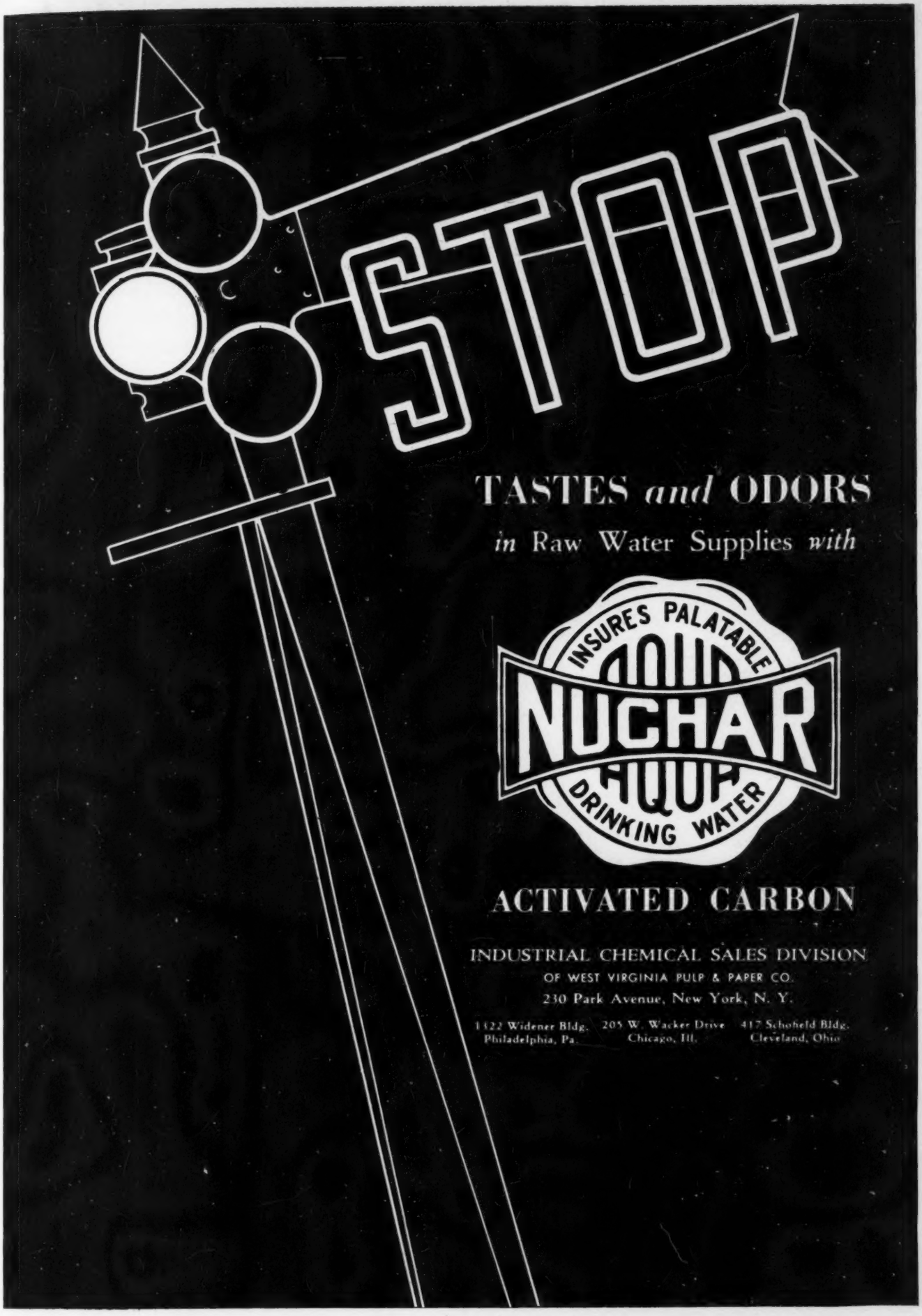
This chart will be found satisfactory for most short pipes where the pressure drop is small, amounting to only 2 or 3 pounds. Most steam pipes are short and it therefore is unnecessary to worry about the complexities to be found in the common steam flow formulas.

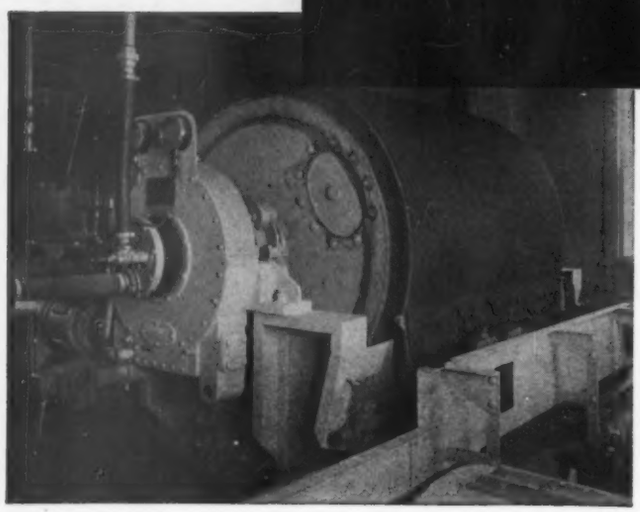
▼

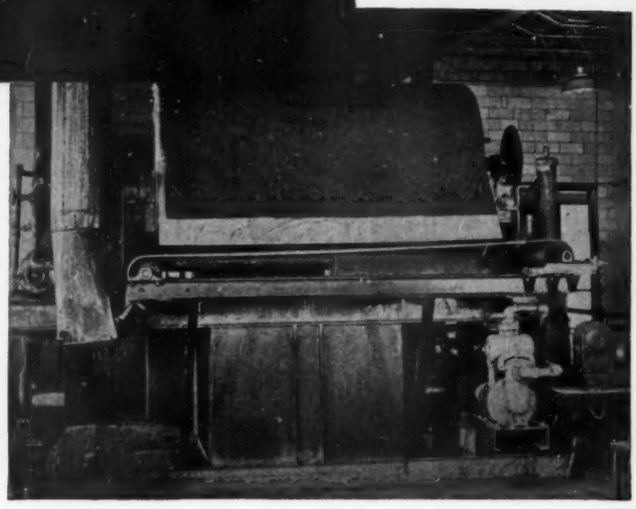
## AN UNUSUAL PIPE LINE

Here is a picture of interesting pipe line construction revealing a method of crossing a western river bed on suspension cables. The 85 ft. towers on each bank are 1,000 ft. apart. The 12 in. diameter pipes were welded by the Lindeweld process on the banks and slid out from each side by cable pull in opposite directions. This view pictures the "pipe line jacks" foot-steering the pipe being pulled to meet in the center, and requiring but a single mid-air weld to complete the job.

*Method of Crossing River Bed on Suspension Cables*


STOP
TASTES and ODORS
in Raw Water Supplies with
INSURES PALATABLE
NUCHAR
DRINKING WATER
ACTIVATED CARBON
INDUSTRIAL CHEMICAL SALES DIVISION
OF WEST VIRGINIA PULP & PAPER CO.
230 Park Avenue, New York, N. Y.
1422 Widener Bldg. Philadelphia, Pa.
205 W. Wacker Drive Chicago, Ill.
417 Schofield Bldg. Cleveland, Ohio





# 4 Recent Installations Emphasizing How OLIVER CONTINUOUS SLUDGE DEWATERERS Serve All Classes of Towns and Cities

**When you place your sanitation problems in the hands of a consulting engineer, you employ an experienced firm. That's logical. Then why not use the same logic when going over detailed plans for equipment and accept their recommendations for "experienced" equipment? Why not insist that the contractor buy it?**

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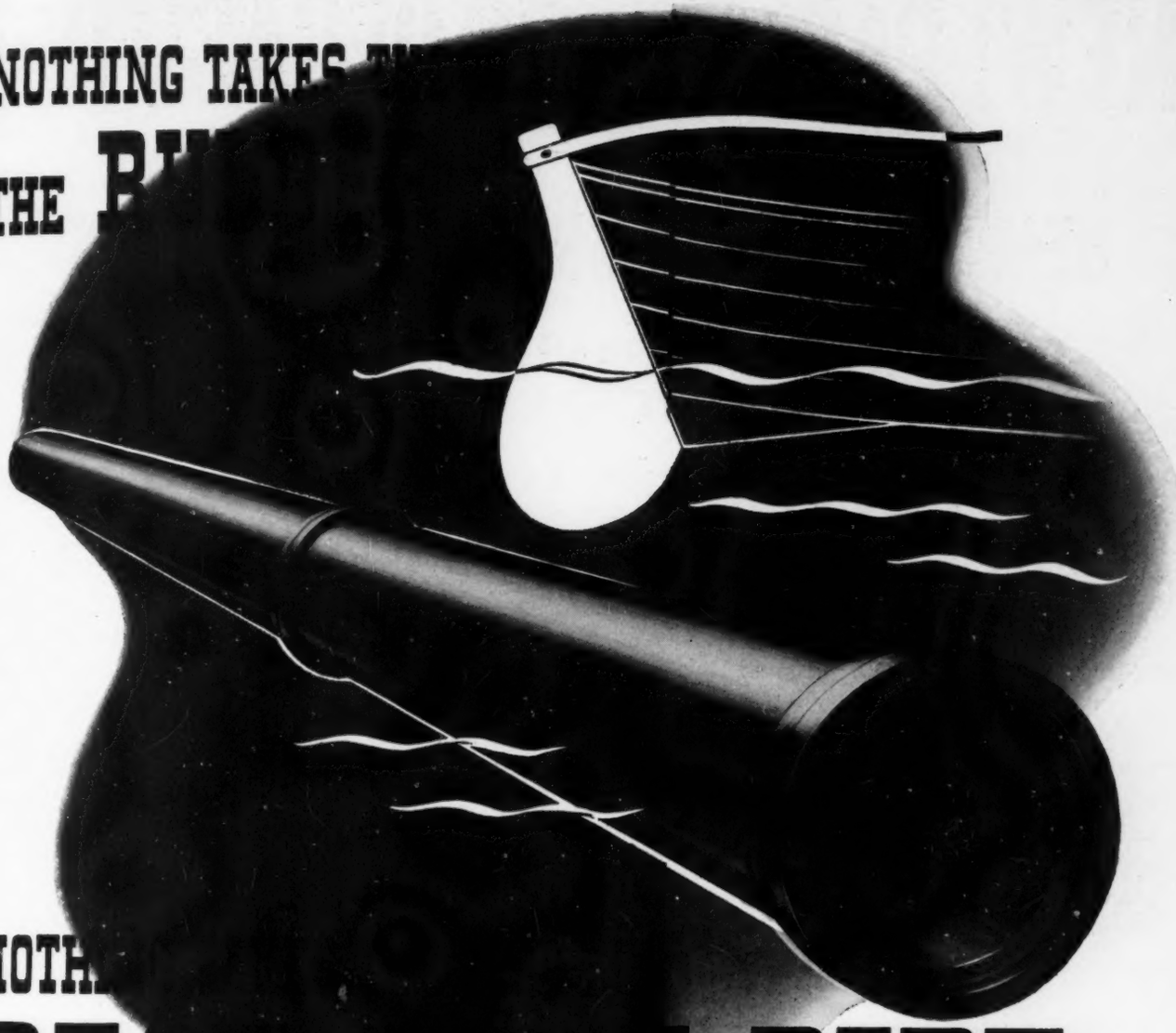

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# CAST IRON PIPE

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Cast iron pipe is made in diameters from 1¼ to 84 inches.

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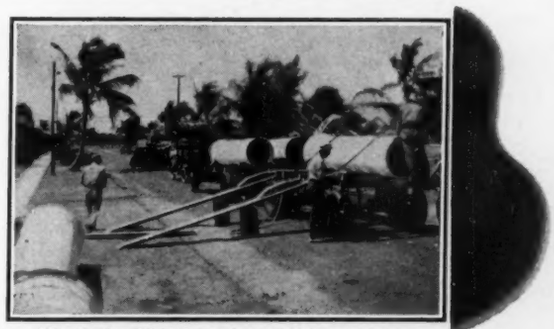

*Distributing 30-inch cast iron pipe for sewer force main at Miami Beach, Fla.*

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# REMOVES ODORS AND OXIDIZES IRON!

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Permutit, world's largest maker of water conditioning equipment, now announces the Degasifier, a more efficient pressure aerator for municipal use. This Degasifier thoroughly scrubs out and displaces $CO_2$ and $H_2S$. And it greatly accelerates iron oxidation for subsequent removal by settling and filtration. It gives efficient, uniform degasification with a maximum of air.

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**COMPLETELY ENCLOSED.** The Permutit Degasifier is entirely enclosed. This is important because: (1) An ever-constant draft system can be maintained regardless of outside weather conditions. (2) The Degasifier can be installed inside or outside a building without fear of splashing and wetting other equipment, a common trouble with less efficient equipment. It is easily cleaned by flushing.

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Inside the Degasifier proper the water cascades over slat trays. Thus the water films are broken up repeatedly and thoroughly. The water flows out from the bottom through an air seal.

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Permutit engineers have made exhaustive tests with degasifiers of different internal construction and heights. They've used varying flow rates of water and air and waters of different character and $CO_2$ content. The knowledge and experience thus gained are now at your disposal. Permutit engineers can recommend for your particular conditions a Permutit Degasifier which will give optimum degasification within a minimum of space and air requirement.

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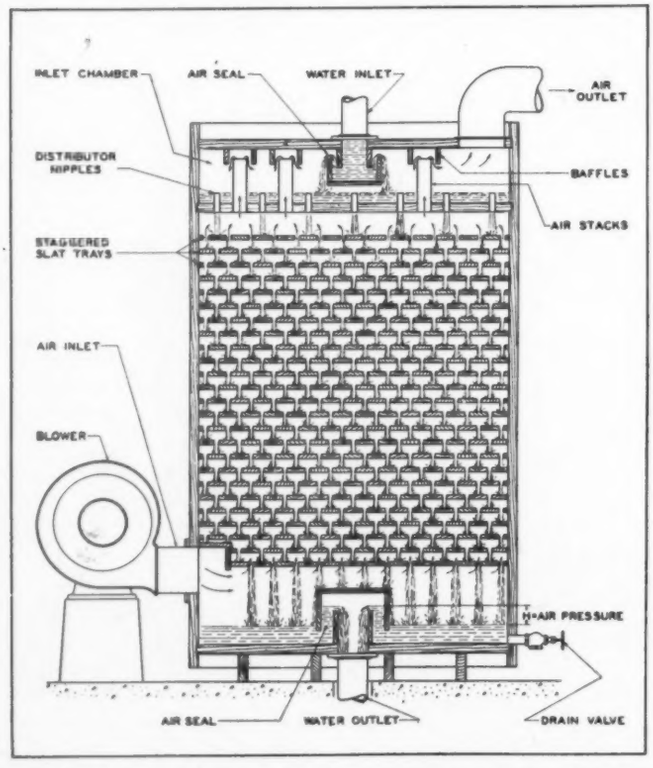
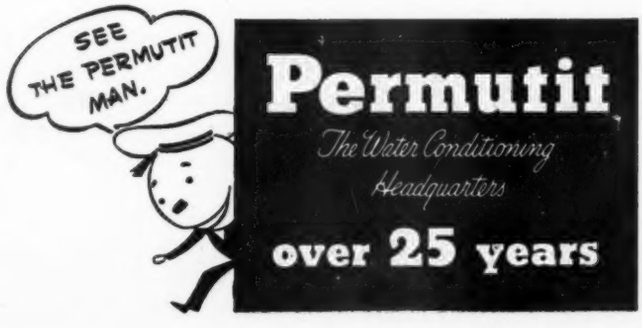



**Section through the new Permutit Degasifier. Arrows indicate air flow. Note compact, efficient arrangement.**

*Water Works and Sewerage—September, 1938*



*Wheeling's Filter Plant*

# CENTRAL STATES SECTION RINGS DOWN THE CURTAIN

## *From it Spring the Ohio, the West Va. and the Western Penna. Sections, in Addition to the Earlier Formed Michigan Section*

WITH the closing of its three day Annual Convention, held in Wheeling, W. Va., on August 19th, the 40 year old Central States Section of the American Water Works Association voted disbandment. And, with the final rap of the gavel of Chairman E. C. Trax, the curtain was rung down on one of the oldest sections of A.W.W.A.

It might have been a sadder procedure but for the fact that where one blade grew there will now be four. Already had the need for individual state sections become apparent, and had last year resulted in the formation of a separate section to serve water works men of Michigan. Already had West Virginia members of the A.W.W.A. applied to the A.W.W.A. Board for authority to establish a West Virginia Section. More recently had Ohio members expressed their desire for an Ohio Section, and members in Western Pennsylvania have decided to set up a separate section to serve that part of Pennsylvania west of Harrisburg, leaving Eastern Pennsylvania undisturbed in the old Four States Section which serves Maryland, Delaware, Eastern Pennsylvania and the District of Columbia.

Indicative of the waning interest in the Central States Section, and lack of sentiment against the passing of the old for the birth of the new, there were no sitters on the mourners' bench and no lamentations. In fact, attendance at Central States' farewell convention was to many a real disappointment. The total registration was something short of 150, of which 18 were attending ladies.

*E. C. Trax, McKeesport, Pa. (His gavel fell; three Sections were born.)*

*A. R. Todd, Wheeling, W. Va. (To him a deserved vote of thanks.)*

### New Sections Elect

With the closing of the convention, members of two of the new-born sections held organization meetings and elected officers to serve for the ensuing year.

**The Ohio Section**

Chairman—W. R. La Due, Supt. Water Works, Akron.

*W. C. Lawrence, Cleveland, Ohio. (Robbed of Chairmanship, but elected Vice Chmn., Ohio Section.)*

*E. S. Tisdale, Charleston, W. Va. (Did a splendid job for the Fuller Award Committee.)*

Vice-Chairman—W. C. Lawrence, Supt. Filtration, Cleveland.

Secy.-Treas—T. R. Lathrop, State Dept. Health, Columbus.

A.W.W.A. Director—W. W. Moorehouse, Supt. Water Works, Dayton.

Trustees—C. E. Inman, Supt. of Water, Warren; M. F. Hoffman, Commercial Supt., Cincinnati; Philip Burgess, Cons. Engr., Columbus.

**Western Pennsylvania Section**

Chairman—Chas. H. Young, State Dept. Health, Meadville.

Vice-Chairman—Edw. A. Johnson, Pittsburgh Meter Co., Pittsburgh.

Secy.-Treas.—Earle P. Johnson, Wallace & Tiernan Co., Pittsburgh.

Director A.W.W.A.—Edw. C. Trax*, Supt. Filtration, McKeesport.

*To fill the unexpired term of H. Lloyd Nelson, who retires after the A. W. W. A. Convention of 1939.

*(1) "Steve" H. Davis, Supt. Benwood-McMechen Water Co. (Master of Ceremonies) and Hayes Kuhn's Leadite Co. (Says there are joints and joints); (2) C. E. Perkins, Engr. Asso. Pub. Util. Corp., Columbus, O.; Mr. Heusel, who fooled us by not registering, and H. D. Neill of Middletown, Ohio, who sells spiral-weld pipe for ARMCO; (3) Mathieson Alkali's Fred Durner (spied reading a good magazine—so, got his pitcher took); (4) Prof. W. W. Hodge, Mellon Institute, Pittsburgh and Wm. Kirchman, Supt. Filtr., Fairmont, W. Va.; (5) Ed. Trax, retiring chairman and recipient of the Geo. W. Fuller Award, with Reeves Newsom, President of A. W. W. A.*

Trustees—Jas. J. Dunwoody, Supt. Water Dept., Erie; M. G. Mansfield, Cons. Engr., Pittsburgh; Arthur Martin, Supt. Water Dept., Oil City.

**West Virginia Section**

Announced that election of officers would be deferred until the meeting of the W. Va. Conference on Water Purification.

## Fuller Memorial Award

The George W. Fuller Memorial Award which is bestowed annually on that member of each section who has made some noteworthy contribution to water works practice, or the good of his section, or the water works profession as a whole, was voted to the retiring chairman—Edward C. Trax, member of A.W.W.A. since 1911.

*W. R. LaDue, Akron, Ohio. (Made Chairman Ohio Section.)*

*T. R. Lathrop, Columbus, Ohio (Sec'y - Treas. Ohio's Section.)*

In presenting this award, E. S. Tisdale did a splendid job of eulogizing the eminent George W. Fuller, and his works. Said Mr. Tisdale—Like him who was being memorialized, Ed Trax had exemplified the power of example, in which high ideals stood foremost in a successful career, involving 25 years of faithful and worthy service to his community. To many small plants he had served as consultant; in many younger men he had created inspiration; in his community he had earned higher and higher esteem. And, in the Central States Section, he had become a power.

## Entertainment Features

To A. R. Todd and his Committee on Convention Arrangements went a vote of appreciation. An entertainment feature was the luncheon and afternoon of recreation in Wheeling's far-famed Oglesby Park, of 750 acres, formerly a country estate and now a recreation area for Wheeling and the countryside for miles around. Here members and guests had their choice of golf, horse-back riding, tennis, bridge, or swimming in one of America's newest and finest pools recently completed as a PWA project.

In the evening was held the Annual Banquet followed by a snappy floor show arranged and directed by Steve Davis, Superintendent of the Benwood-McMechen Water Company, as Master of Ceremonies, who was pitting Benwood's talent against Wheeling's. Lots of fun, and a good party.

In brief speeches Secretary Harry E. Jordan and President Reeves Newsome outlined "Progress and Plans of A.W.W.A.," looking toward an expanding association capable of benefiting the greatest numbers in the direction of social as well as technical advancement in the matter of better practices and more meaningful specifications for materials and equipment. Stressed were the benefits accruing from State Sections to such ends.

Later in the meeting Secretary Jordan thanked all concerned for the spirit of progress which had been shown in the dissolution of the less wieldy Central States Section for the new sections. Proving the wisdom of the split, in less than one year 37 new members had been added by the Michigan Section, which is now holding its meetings conjointly with the Michigan conference on Water Treatment. Ohio, already with a strong conference on Water Purification, would now be in a position to better serve water works managers through meetings within the state. The idea of dovetailing of such conferences and section meetings was of high importance. The Western Pennsylvania Section had 90 members to start with and the Ohio Section a few more than this number, both looking to marked increases.

## Technical Sessions

The first technical session opened with a group of papers constituting a symposium on "The Ohio River and Its Relation to Industry and Public Health."

**"To the Steel Industry"**—R. B. SMITH, Engineer, Wheeling Steel Co., in reviewing the importance of water in steel and steel products production, revealed that 270 tons of water was required in the production of 1 ton of steel, his company alone requiring 154 billion gals. of water per day. While the steel industry considered the river as "a convenience rather than a national resource" and could not comprehend the need for non-acid waters, nevertheless through the American Steel & Iron Institute an intensive study of recovery and treatment of acid wastes from steel production had been recently started at Mellon Institute for Industrial Research, under Professor W. W. Hodge.

**"In Power Production"**—R. G. CALL, Chief Chemist, American Gas & Electric Corporation, Power, W. Va., being unable to attend, his paper was presented by an associate. He told of the high cost of acid streams to the power industry, as represented by corrosion of

*(1) Max Priester, Supt. Filtr., Oakmont, Pa., and J. L. Martin, Warner Lime Co., Pittsburgh; (2) The "Nuchar Twins"—Welch (N. Y. City) and Statham (Cleveland); (3) Homer Beckwith with his boss—Ed. Case, President of the Pitometer Co., N. Y. City—and Jim Brown, Natl. Water Main Cleaning Co., Columbus, Ohio; (4) Arthur Martin, Supt. of Water, Oil City, Pa. (Trustee Pa. Section) and O. E. Decker of Johns-Manville Co., Youngstown, Ohio; (5) Paul Harlamert, J-M's Cleveland Manager and W. R. LaDue.*

condenser tubes, deposition of iron and alumina scale, cost of boiler water preparation; priming and foaming due to phenolic wastes; interference with slime control on condenser tubes by simple chlorination because of chlorine consumed and production of ferric precipitates on the tubes. Most important were the variations in acid, organic and iron content of the streams. With even partial treatment and gradual release of waste much could be accomplished to benefit all water takers.

**"Effects on Public Water Supplies"**—PAUL SIMMONS, Sup't Water Treatment, and Chemist of the Weirton Steel Co., Weirton, W. Va., presented a brief description of the plant, treatment employed and chief difficulties experienced by numerous plants on the Ohio and its tributaries. He pointed out that a gradual lowering of acidity of streams had brought on a biological problem in addition to the chemical problem. With less acidity, growths of micro-organisms had contributed worries in the nature of tastes and odors. Also, with less acid reaction, more putrefaction and less bacterial destruction resulted.

(Later in the meeting someone commented that reduced iron content of the raw water had materially increased coagulant requirements, and hence the cost of treatment, indicative of the value of steel mill or mine wastes in controlled moderation.—Ed.)

At this point JOHN W. HANDLAN, Director of Public Relations, Wheeling, Wa. Va., spoke of the effects of pollution in driving recreationists and sportsmen from the natural water-ways. It was his thought that the water purification engineer had a duty to the general public to discharge in fighting for cleaner waters at water works intakes.

## Flood Control on Water Quality

**"Contemplated Flood Control Dams and Their Anticipated Effects on Water Quality Change,"** by D. D. RAIT, Corps. U. S. Engineers, Project Section, Pittsburgh, Pa.

In an excellently presented paper Mr. Rait reviewed the flood control program involving 9 major reservoir projects, on streams in the upper Ohio basin, in which controlled release of impounded waters would double the minimum flows in the upper Ohio and those tributaries involved. He cited data indicative of the expected chemical quality of the impounded water, namely, 40 ppm. alkalinity and 50 ppm. total hardness at pH 7.2. The effects of controlled dilution on water supplies of 5 principal cities were cited. At Pittsburgh, for instance, the serious acidity of 1934 and highest recorded hardness (1932) could have been prevented for duration of such low flows with a calculated discharge of 85 per cent of the contemplated impounded water. To effect proper control of water release would entail maintenance of reporting control stations on the streams involved. Compared with acid mine drainage, acid wastes from steel mills was but a drop in the bucket when considering the value of controlled dilution. Seemingly, if the acidity range was to be lowered, something must be done in respect to reducing pollution from sanitary sewage in the Pittsburgh area.

**"The Effects of Low Flow Augmentation on the Beaver River,"** by CHAS. H. YOUNG, Distr. Engr., Penna. Dept. of Health, Meadeville, Pa.

Mr. Young presented supporting data to show the effects of controlled dilution of Beaver River, on water quality, resulting from operations of a large storage reservoir on its head waters during the past three years. The reservoir was built to augment river flows at times when high temperatures of the many times re-used flows created difficulties in steel mill operations. On the water shed are 70 municipalities—(500,000 sewered population)—and 475,000 people were dependent upon Beaver River water supplied through filtration plants at Sharon, New Castle and Beaver Falls. Into the river it had been estimated that 60,000 lbs. of sulphuric

*J. B. Harrington, State Dept. Health, Charleston, W. Va. (Sec'y W. Va. Conf. on Water Purification); G. Webber Knight, Mgr. Water Works, Natrona, Pa. (Immediate Past Pres. Penna. Water Operators' Assn.); A. J. Dotterwich, Engr., Permutit Co., Pittsburgh.*

acid is dumped daily by steel mills. On the water shed 18 municipalities in Pennsylvania and 8 in Ohio had provided sewage treatment. By raising flows of the river (at Sharon, Pa.) to 200 sec. ft. from the less than 40 sec. ft. for 30 per cent of the year, acidity had been controlled to a point where the b.coli index had been increased from 200 then to 6,000 now. The oxygen balance in the stream had been less favorable and color of the water had risen, due most probably to decomposition of organic matter in the reservoir. Algae and taste and odor troubles had increased, requiring all known methods of correction, and chemical costs for treatment had increased by 33 to 66 per cent. In summary, Mr. Young pointed out that the scheme had been of value to industry in lower temperatures of cooling water. To water plants a benefit in greater uniformity of water quality in respect to industrial pollution loading, but an inferior raw water during a great part of the time and added expense in treatment. All of this could be charged to the inferior quality of the diluting water.

*(1) F. H. Weed, Engr., Penna. Water and Power Res. Bd., Pittsburgh, and Philip Burgess, Cons. Engr., Columbus, Ohio (Trustee Ohio Section); (2) Jas. Hapgood, Inspector, and C. E. Inman, Supt. of Water, Warren, Ohio (Trustee Ohio Section); (3) Sec'y-Treas. Earle P. Johnson (now holds same office in new Western Pa. Section) and his "principle assistant," Miss Edna McCracken, loaned by Wheeling's Chamber of Commerce; (4) E. A. Morgan, Supt. of Water, Wellsburg, W. Va., and John R. Sproat of Pittsburgh Equitable Meter Co.; (5) A. E. Griffin, Chemist, and F. P. Rischer, Wallace and Tiernan's Cleveland Manager.*

## Water Supply Improvements Through P.W.A.

E. S. TISDALE, Chief Engr., W. Va. State Dept. of Health, presented an enlightening review of the "Effects of P.W.A. Projects on Water Supply and Public Health in West Virginia" to date. Most important had been the benefits thus accruing to small communities. In the three programs there had been 100,000 people benefited in 75 West Virginia communities, involving 60 water supply projects and 18 sewerage projects at an expenditure of $5,500,000. As an outcome West Virginia had launched into a real sewage treatment and waste treatment program. Also impetus had been given to water softening as the outgrowth of P.W.A. assistance, Clarksburg and Parkersburg being the largest communities to adopt softening. In providing sewage treatment, Bluefield had been the largest city and now

**"Bedfellows"**

*(When it comes to filter problems)*
*R. B. Adams, Chemist, Pa. Water Co., Wilkinsburg, Pa.; M. U. Priester, Chemist Suburban Water Co., Oakmont, Pa.; H. G. Turner, Engr., Anthracite Inst., State College, Pa.*

Beckley had two plants under construction. Again, Mr. Tisdale stressed the fact that so many small communities now had satisfactory public water supplies, otherwise not considered possible.

F. H. WARING, Chief Engr., Ohio State Dept. of Health, presented the picture of water supply improvements in Ohio through Federal aid, in which 132 communities benefited. Amongst these were 76 completely new systems during the four years, 18 being W.P.A., 58 P.W.A. projects serving communities of minimum population of 200 and a mean population of 800. The expenditure for water works alone had been $16,500,000 in Ohio during the past 4 years. From the results, Ohio authorities now considered no community too small to finance a public water works system. Among new treatment plants 39 had been softening plants, 8 iron removal and 1 straight filtration plant. In the present (third) program 73 municipalities had applied for water supply betterment, running to $15,250,000 already, and likely to be doubled before the deadline date of September 30th.

Concerning stream pollution abatement $43,000,000 had been spent in Ohio during the past 4 years, Columbus, Cleveland and Dayton being the major projects. Youngstown, now the most important offender left, was next in line. Mr. Waring revealed a little known fact, that the Ohio River is legally without the control of Ohio authorities, because Ohio territory legally stops at the shore line of the river. He cited the strides made in the Ohio River Basin Compact, entered into by 8 states to curtail pollution of the river systematically. Mr. Waring revealed also that the Federal anti-pollution (Vinson) bill, vetoed by the President, would with one minor alteration be signed by him during the next session of Congress. It began to look as though some real stream cleansing was being launched in the Ohio Basin and in the U. S. generally.

H. E. MOSES, Chief Engr., Penna. State Dept. of Health, who had not been forewarned to come prepared to present figures and statistics, reviewed progress being made in Pennsylvania. He said that water quality was becoming a consideration now, as much as safety, and Harrisburg and Bethlehem were contemplating leaving their river supplies and going to upland sources for a better water. In pollution abatement, the important Alleghany River water shed was now essentially 100 per cent served by sewage treatment plants. The Sanitary Water Board was making rapid progress and had launched an important program for the complete clean-up of the Juniata River, and Philadelphia was to be required to do something more than make promises and plead poverty. In the Pittsburgh area progress in the matter of establishing a metropolitan Sewerage District was worthy of note.

## Removal of Iron and Manganese From Filter Beds

**"The Removal of Iron and Manganese Coatings from Sand Filters,"** by R. B. ADAMS, Chemist, Penna. Water Co., Wilkinsburg, Pa.

Mr. Adams in an outstanding paper, described the two types of filters (16 m.g.d.cap.) at Wilkinsburg—the shallow bed units having 11 in. of gravel and 20 in. of sand and the deep units 30 in. of gravel and 25 in. of sand, one of the latter having a 34 in. bed of "Anthrafilt" since 1935. Troubles from sand grain coating and gravel cementation had resulted from depositions of manganese, carbonate, iron and silica. In using alum and lime coagulation (pH 6.8 to 7.2), practically all of the iron is removed but only 15 per cent of the manganese drops out in the basins and 10 per cent is taken out on the filtering media, leaving 75 per cent in the finished water. During peroids of high acidity and high manganese runs in the river, lime must be boosted to produce pH values of 9.4 to 9.6 in the mixing basin.

*(1) At the Wheeling plant members and guests see a demonstration of filter cleansing with sulphur dioxide; (2) In the hotel lobby a group around the radio set listening in on Sec'y Harry Jordan who is on the air "selling" water-works men to Mr. John Q. Public; (3) Master of Ceremonies, "Steve" Davis, puts on the show (apologies for the poor light); (4) Cylinders of liquid $SO_2$ and unique handling carriage at the filter plant; (5) J. G. Patrick explains the procedure and demonstrates the "$SO_2$ Purge" of a Wheeling bed.*

In passing through the filters a pH of 9.0 is reduced by carbonate depositions to pH 8.6 and 97.3 per cent removal of manganese is secured.

In studying the bed depositions the shallow beds were found coated down through the gravel, while the deep beds were affected only 3 to 4 in. down. Interestingly, only the finest grains (25 min. and less) were found seriously coated. Return to low pH coagulation caused much of the deposit to be re-dissolved or loosened from the grains. In the "Antrafilt" bed (0.7 min. effective size) considerably less coating had been detected—namely, 16 lbs. per cu. ft. of sand as against 7.75 lbs. per cu. ft. of "Anthrafilt." Charts presented showed that after 8 months since return to pH 7.0 coagulation (alum and lime) the coatings on the "Anthrafilt" had essentially disappeared, but not so in the case of sand. Analysis charts showed manganese leached from the coatings had only been 38.4 per cent from the sand grains but 92.5 per cent from the "Anthrafilt." Interesting was the disclosure that very little of the coating on the latter was silica, whereas the sand coating contained about half as much silica as calcium carbonate. In bed cleaning caustic soda soaking had been effective; at other plants chlorine or sulphur dioxide had been effectively used.

In summarizing, Mr. Adams emphasized the following facts: (1) That effective size of grains appeared to play an important role in grain coating during high lime treatment; (2) That "Anthrafilt" grains (0.70 E.S.) had less than one-half the coating that 0.55 E.S. sand took on; (3) That only 76.5 per cent of the deposit left the sand beds during low pH treatment, whereas 99 per cent left the "Anthrafilt"; (4) That silica and manganese content had always been much higher on the sand grains than on "Anthrafilt."

MAX V. PRIESTER, Chemist, Suburban Water Co., Oakmont, Pa., in discussion, stated that for his plant water was taken 5 miles above the Wilkinsburg plant. Suffering from sand bed deposits, they had experimented with acid, caustic, and super-chlorination treatments of the sand. The latter had proved the most practical and satisfactory over a period of years. The procedure consisted of applying chlorine gas (through diffusers) to water on top of the sand, to secure 150 to 200 p.p.m free chlorine in solution, and then drawing the strong chlorine water down into the bed. After 24 hours' standing the sand was stirred by hose-jetting. The application required 10 lbs. of chlorine to a bed of 180 sq. ft. area. He, too, had found that new fine sand coated much more rapidly than old coarse sand. The effect of the chlorine was probably a combination of carbonate attack to release carbon dioxide and disintegrate an otherwise dense coating containing iron and manganese.

H. G. TURNER, Research Engr.. The Anthracite Institute, State College, Pa., in complimenting Mr. Adams on his studies and method of reporting, said that he would now have to revise his statement that "Anthrafilt" grains would not coat up and say, now, that "Anthrafilt" would not coat up as much and would clear up more rapidly than sand. Seemingly the high silica content on the sand grain coatings indicated a chemical combination between the carbonate deposit and the sand grain surface.

**"Cleaning Filter Sand with Sulphur Dioxide Gas,"** by J. G. PATRICK, Chemist, West Va. Pulp and Paper Co., Piedmont, W. Va.

Mr. Patrick explained the procedure of applying liquid sulphur dioxide to filter beds for the purpose of removal of severe coatings from sand grains. Samples of filter sands, before and after cleaning, were exhibited. Later at the Wheeling filter plant the results of cleaning were demonstrated by washing a freshly treated filter. The procedure involved the use of liquid sulphur-dioxide under 35 lbs. pressure in steel cylinders similar to chlorine containers. Inverting a 100-lb. cylinder allowed liquid sulphur dioxide to enter the filter manifold while admitting water to slowly fill the bed—the aim being that of producing an active solution of 3 per cent strength, or less, as the preliminary laboratory-scale test indicated. Having filled the bed a recirculation pump and hose line is employed to more effectively distribute the sulphur dioxide solution and loosen the coatings, subsequently washed free by an on-and-off back wash, after 18 or more hours of standing.

**"Programmers"**

*H. M. Olson, Ohio Salt Co., Mt. Lebanon, Pa.; Paul Simmons, Weirton Steel Co., Weirton, W. Va.; W. M. Baumgartner, Du Pont Co., Wilmington, Del.*

Mr. Patrick pointed out that sulphur dioxide worked more effectively on manganese and iron deposits than had other schemes. This he attributed to its combination effect of mild acidification in addition to its reducing power. On filter sand coated with calcium carbonate he warned against use of sulphur dioxide, which formed calcium sulphite and sulphate resulting in cementing the sand grains and gravel. As to corrosion, solutions up to 3 per cent $SO_2$ (pH = 4) would not attack metals, whereas the usual requirement had proved to be roughly a 2 per cent solution, which he advocated be repeated yearly as a "spring tonic" to filter beds.

*P. L. McLaughlin, Chemist, W. Va. Water Co., Charleston, W. Va.; Chas. L. Fox, Asst. Supt. Pa. Water Co., Wilkinsburg, Pa.; M. R. Baker, Supt. Water Dept., Tarentum, Pa.*

Mr. Patrick reviewed some of the results from the treatment at Batavia, N. Y.; Frostburg, Md.; Gastonia, N. C.; Mt. Vernon, Ind., and at his own plant at Piedmont, W. Va., in which savings in wash water alone paid for the sulphur dioxide. As to costs in comparison with mechanical cleaning of the sand alone, the treatment had figured $1.40 per cu. yd. as against $1.60, but the latter figure did not include the cost of removing and replacing gravel. In chemical cleaning that expense and trouble was avoided entirely.

**"Silicate of Soda in Water Treatment"** by W. M. BAUMGARTNER, Chemical Engr., The DuPont Company, Wilmington, Delaware.

Mr. Baumgartner presented a review of the technical aspects and published experiences with silicates of soda in water treatment. In corrosion control, the most commonly employed dosage had been 0.8 gr./gal. of commercial silicate solution, providing a dosage of 8 p.p.m. Si $O_2$. Its use to date had been more prevalent in industrial than municipal plants and has especially been favored in checking corrosivity of Zeolite softened waters, and those of very low hardness. The method was favored because it added no hardness and did not require exact control, or even continuous application.

As an aid in coagulation, Mr. Baumgartner reviewed the work and experiences of John R. Baylis at Chicago (covered in a series of articles by Mr. Baylis in WATER WORKS & SEWERAGE) and also the definite advantages proved at the Wheeling plant and elsewhere. This use consisted of diluting commercial grade silicate solution (ratio of Si $O_2$ to $Na_2O = 3$ to 1) to a solution containing 1.5 per cent Si $O_2$ and, thereafter, "activating" the silica by adding sulphuric acid to an end point where the alkaline balance was just pink to phenolphthalein—i.e., pH 8.4 roughly and total alkalinity of 1,200 to 1,500 p.p.m. On standing (aging) the peptized silica passed over to the negatively charged sol. stage. If over acidified the gel stage would be reached, the batch would solidify and the Si $O_2$ lose its effectiveness by taking on positive charges before application to the water.

Application of the activated sol. of silica had revealed remarkable effects in speeding up floc formation, productive of larger and tougher (higher gravity) floc agglomerates, materially reducing coagulant requirements and basin sizes, and lengthening filter runs. One very practical added aspect had been the need for less exact pH balance for satisfactory floc formation. The extent of benefit would be dependent upon the quality of raw water in respect to silica content and the form in which the silica was present. Adaptation of silicate treatment allowed increased rates of filtration and effective use of coarser grained filter beds. (See article in this issue, by John R. Baylis, which deals with these practical aspects of silicate treatment.—Ed.) Mr. Baumgartner pointed out the successful adaptation of a very similar scheme at the St. Louis Softening Plant. Devised by A. V. Graff, non-acidified silicate solution was being added to the alum solution en route to its point of application, with results similar to those procured in the Baylis batch-method of silicate preparation before application.

Mr. Baumgartner, in describing commercial silicates, stated that they were necessarily marketed in solution form in 650-lb. steel drums or tank cars. Those silicates most adaptable to water treatment had ratios of silica to caustic soda between 3¼ and 2 parts of Si $O_2$ to 1 part $Na_2O$, and contained from 27 to 35 per cent Si $O_2$ by weight.

A. R. TODD, Supt. of Filtration, Wheeling, W. Va., recited his interesting experiences with silicate treatment. Ordinarily, the soluble silica content of the Ohio water at Wheeling ran about 9 p.p.m., which was not reduced by the coagulation and filtration. However, after flood water crests, during the run-down the story was different and coagulant costs ran up smartly with the difficulty of maintaining satisfactory flocculation at all dosages. By check up, it had been found that during these periods (about 40 per cent of the time) the soluble silica content reached the vanishing point. Trial of the Baylis method had yielded astounding results and 0.2 gr./gal. of silica with 0.2 gr./gal. of sulphate of iron (oxidized with chlorine) had yielded results superior to 3 gr./gal. of coagulant alone. Dropping to 0.1 gr./gal. of silica dosage resulted in a water of 25 p.p.m. turbidity reaching the filters, which was dropped to 5 p.p.m. upon returning the silica to the 0.2 grain dosage. Such value of silicate treatment had been demonstrated on several occasions.

**"The Langalier Corrosion Index,"** by PROF. W. W. HODGE, University of W. Va., Morgantown, W. Va. (now on leave of absence at Mellon Institute, to investigate methods of curtailing stream pollution due to acid iron wastes from steel mills).

Professor Hodge did a credible job of explaining the theory and formulae presented by Prof. W. F. Langelier, of California, in his article in the October, 1936 issue of the A.W.W.A. Journal, from which is derived the "Langelier Index" revealing the degree of corrosivity or encrustation of waters. Basically the formula takes into account the total solids content, nature of alkalinity and temperature of waters in arriving at the correct normal carbonate content to carry in corrosion suppression; likewise to preclude encrustations due to calcium salts in softened waters. He especially emphasized the Langelier contribution, presenting tables of calculated constants for use with the simplified formula for arriving at the calcium carbonate saturation index. Prof. Hodge pointed out that pH determinations used in the formula should be made with electrometric equipment rather than colormetrically, for accuracies recommended by Professor Langelier. Likewise, the free $CO_2$ content should be computed from alkalinity and pH determination rather than depend upon titration results, which were shown to be very erroneous in cases. The dependability of the Langelier Index had been confirmed in a paper by DeMartini and co-workers in a study involving 5 waters as reported in the A.W.W.A. Journal for January, 1938. Professor Hodge then demonstrated the meaning of saturation equilibria and also corrosion phenomena.

CHAS. P. HOOVER, Cons. Chem. Engr., Columbus, Ohio, a scheduled discussor, sent in a contribution by mail which consisted of the Langelier factors plotted in graph form, and also a nomographic chart to facilitate calculations of the index number.

L. H. ENSLOW said that the Langelier Index Number definitely spotted corrosive and encrusting waters. He agreed that titration of free $CO_2$ was likely to lead to great errors, as he had experienced. Long ago the scheme of determining total alkalinity and pH value, and then reference to a prepared graph for spotting the free $CO_2$ content, had been resorted to. (See WATER WORKS & SEWERAGE Reference and Data Issue 1938, page 472, for a copy of the graph referred to. —Ed.)

R. C. BARDWELL, Supt. Water Supply, C. & O. Railway System, Richmond, Va., expressed the opinion that use of the Langelier Index in controlling water treatment was not practical where raw water quality was subject to rapid and frequent changes, but had a value in connection with stored waters not subject to marked variations in chemical or physical composition.

**"Benefits and Monetary Savings Resulting from Municipal Water Softening,"** by H. M. OLSON, Ohio Salt Company, Mt. Lebanon, Pa.

Mr. Olson has compiled a real compendium of information on municipal softening practice, and advantages accruing. When published, his contribution will represent the most complete and extensive reference work yet published on this topic, appended to which is an extensive list of references to the literature on water softening. Of considerable value to those attempting to put through water softening projects are his references to monetary savings accruing to water users as the outcome of municipal softening. He cited the Neenah-Menasha, Wis., campaign as an especially well conducted one in educating local taxpayers as to the value of soft water prior to the bond election. In making consumer surveys, subsequent to introduction of municipal softening, nothing but praise had been recorded. This in the face of the fact that before softening many had fought softening on the grounds that it would result in a less palatable water. Savings cited by Mr. Olson ran from fewer plumber bills and longer life of clothing, to a saving in razor blades and tender faces. Concerning growth of softening in America, Mr. Olson pointed out that only in 1924 had the first municipal Zeolite plant been installed in Laurens, Iowa. Now (April, 1938) there were 109 such plants which, with 285 chemical precipitation plants, gave a total of 394 municipal softening plants supplying a population of 7,250,000 people, the majority living in the State of Ohio. The new carbonaceous (Hydrogen Zeolit) method of softening had been in use in Mt. Victory, Ill., for more than a year.

A. J. DOTTERWICH, Engr., The Permutit Co., Pittsburgh, Pa., stated that statistics showed that the cost of many softening plants was paid for in savings within two years. Savings to householders could be shown more than ample to pay the water bill each year. The cost to those operating household softening units (selfishly refusing to vote for municipal softening), was actually 5 to 10 times the cost of providing the same soft water through a municipal system. More often than not, plumbers, politics and pin-heads stood in the way of softening benefits to the community, than was generally realized. To override this type of hurdle, Mr. Olson had compiled a most valuable lot of information and argument and also ammunition.

**"The Question of Promotional and Special Rates,"** by W. R. LADUE, Chief Engr., and Supt., Bureau of Water, Akron, Ohio.

Mr. LaDue in discussing service vs. dividends from municipal plants, stated that establishment of special rates to popularize the water utility was more hazardous than sound. In fact, most public utility commissions would rule special rates to be discriminatory, regardless of the motive behind them. On the other hand, the offer of "off-peak" rates at reductions were directed to a different end and promotion of off-peak consumption was a technically and financially sound policy. In Akron, off-peak rates allowing 50 per cent discount on excess industrial consumption had been allowed industrial plants caught with a deficiency of private ground water supply during drought years. At another period 5 m.g.d. had been diverted to a drought hit stream, for industrial usage, at a special rate representing bare cost of treatment, namely, 1.1 cents per 1,000 gals. This in truth was an emergency, discontinued at the first opportunity, but saved plant shut-downs and a $750,000 payroll at a cost of $6,000.

In general, Mr. LaDue had found upon investigation, that promotional rates lead to no good end. Those most able to pay reaped greatest benefits—such was true in allowing special summer sprinkling rates. In respecting to building public relations, a small general rate reduction was more effective than special rates.

REEVES J. NEWSOM, Cons. Engr., New York City, cited the case of Marion, Ohio, in which an over capacity of the treatment plant, due to cutting loose of large industrial users, made it feasible to offer reduced sprinkling rates with a worth while net income gain. It was perhaps the exception to the rule.

W. W. BRUSH, Editor, "Water Works Engineering," New York City, stated that when he was Chief Engr. of the New York Water Department, "off-peak" rates consisted of no reduction, but a requirement that large users take water during the off-peak hours, or none at all. In fact, for political reasons, the small consumer was favored and industrial users taking one-fourth the total water consumed paid one-half the water bill of New York City.

**"Cone Valves and Their Application in the Water and Sewage Field,"** by DAVID GOLDBERG, Chapman Valve Co., Indian Orchard, Mass.

In what seems to be the first paper ever presented before the Association which is devoted solely to cone-valves, Mr. Goldberg described this type of valve, explained its workings, and cited its merits and applications in the water and sewage field. He likened the cone-valve (dating back only to 1928) to a glorified

**In Oglesby Park**

(1) *A little nymph (Ye Ed's Nancy) liked Wheeling's new pool; so did her Daddy;* (2), (3) *and* (4) *Luncheon is served in the nearby picnic and luncheon house;* (5) *A partial view of pool and pool-house of which Wheeling and P. W. A. are proud.*

corporation cock with such features as ease of operation, full flow orifice, assured tightness and of self-cleansing design. As to ease of operation (manually, hydraulically or electrically) 25 turns of the stem were required to unwedge the seated cone to secure only 60/1000th inch clearance between the annular seat rings. Then in hydraulic balance, 60 turns more were required to completely open the valve by turning the floating cone through 90 degrees. Thereafter, 15 more turns were required to re-wedge the cone in the open position, 200 turns in all being required to open and close, but with an ease hardly believable.

As to applications, these valves had been put to many uses, being favored as check valves and also for surge suppression; and as pressure and flow regulating units, automatically controlled. In fact, frequently a single valve was called upon to serve more than one function.

To the question, "How do cone valves function to control surge and water hammer?", Mr. Goldberg stated that absolute control was not possible with an automatic cone-valve alone. But, by proper timing of closure, when serving as a check valve, the surge was materially reduced. The "Surge Suppressor" is the cone-valve which automatically opens to waste when excess pressure is felt on the line, and closes gradually thereafter. In surge elimination two cone valves were required, unless the pump could be allowed to run backwards for short duration without damage to the motor. Automatic units placed in a gravity or pressure main operated in a reverse fashion and closed gradually on low pressure, such as would result from a line break.

(A splendid example of such use of cone valves is to be found on the long Fort Smith, Ark., supply line.—Ed.) As check valves, such features as low friction loss (no flapper riding on the stream, and a full water-way opening), hydraulic balance and ease of operation, and assured tightness, had made them popular for check valve duty.

**"Development of Specifications for Powdered Activated Carbons,"** by M. M. BRAIDECH, Asst. Prof. Chemical Engineering, Case School, Cleveland, Ohio.

Mr. Braidech presented an impressive resume of the work of the A.W.W.A. Committee on Specifications and Tests for Powdered Activated Carbons, of which he was chairman. The committee, which began activities in 1933, made interim reports in 1935, '36 and '37, with a final report in 1938—which was the outcome of studying 10 carbons, and extensive study of various laboratory evaluation procedures correlated with operating results. Concerning laboratory evaluations, the selection had narrowed down to two principal tests—the phenol absorption test and the threshold odor test. There had appeared to be no definite relationship between the two tests, and in actual use the threshold odor test had become the most important of the two, because the odor problem had been found prevalently due to algae and products of vegetable decay rather than phenolic bodies. With the completion of the committee report (now published in the August, 1938, issue of the A.W.W.A. Journal) a new committee had been set up to continue study of activated carbons, namely, the Committee on Activated Carbon Research, on which are several manufacturers' chemists in addition to operating chemists. (Headed by Mr. Braidech, this committee will without much question be the cause of further improvements in carbon qualities and in advancing the technic and economics of application. The former committee in 5 years did a splendid job under an energetic chairman.—Ed.)

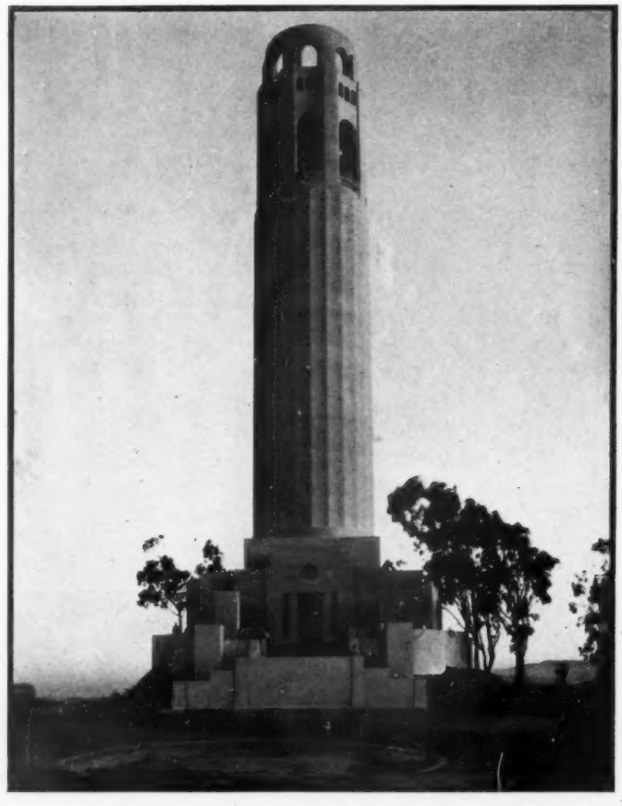
## A Water Tower?—No—But It Should Have Been

This architectural gem stands on historic Telegraph Hill on San Francisco's bay front. We, like many others, have admired it for its impressive stately beauty and it is here pictured as a suggestion of what can be done in the way of making elevated tanks or stand-pipes attractive.

This structure recalls interesting history in a Municipal activity allied to water supply. This shaft was erected as a memorial to the most renowned of all San Francisco's volunteer "firemen." She was Lily Hitchcock Coit, known in California's gold-rush days as "Lily the Vamp," and in many ways a most remarkable woman. When she reached San Francisco in 1850 the city had just been burned out and her interest was thereafter directed to providing more adequate fire-fighting facilities. For her activities, the highest honor was bestowed in her election to the famed Knickerbocker Fire Co. No. 5, as a "full member." These volunteer companies were not alone potent political forces, but were also the equivalent of the city's most exclusive clubs. Lily Coit's influence in San Francisco became great and when she died in 1929 she bequeathed a substantial sum to be expended in further beautification of "the city I always loved."

To "Lily the Vamp's" memory this shaft 181 ft. high was erected by the city from some of the money she left it. It has always seemed a pity to us that it was not also made to serve as a water-tower. The architect conceiving and designing this dignified observation tower was Arthur Brown, Jr., and the erection was done by Contractors Young and Hortsmeyer.

(Telegraph Hill got its name in the days when it served as a vantage point for sending and receiving wig-wag messages to ships entering or leaving through the Golden Gate.—Ed.)



*Coit Tower*

# The New EVERSON

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● We are ready to announce a new "Automatic Vacuum Controlled" Chlorine Sterilizer for the water works and sewage field. This new Chlorine Control Apparatus is the result of extensive work in developing and perfecting Chlorine equipment during the last few years—equipment especially adaptable for water works and sewage applications.

This new instrument which measures and feeds Chlorine Gas as a solution has many new and improved features which make it automatically safe and accurate under not only all usual but unusual circumstances as well. Briefly it is described as a Rota-Meter (or Rota-relay for large capacities) Automatic Gas Shut-Off Vacuum Sterilizer and embodies the following designed features: Exceedingly accurate, visible control of gas flow; Great capacity range—ratios from 1½ to 65; only two moving parts; single valve control located directly below visi-meter; automatic gas shut-off should water pressure fail thru pump stoppage, line leak or other causes; electrically operated water shut-off—synchronizes "on" and "off" of sterilizer with that of pump; complete vacuum feed, separation of water and gas lines; water sealed gas vent with syphon break that prevents back flooding; —will operate with low water pressure; all parts easily accessible and entirely non-corrosive—parts which contact chlorine as gas or in solution are rubber, glass, silver or tantalum; Standard (SAE) threads and parts for easy servicing, etc.

This new Sterilizer which though complete in up-to-the-minute features, will be in the "low price field." It is offered in a choice of modern enamelled steel cabinets—in Tower (set back) or Panel designs. The entire Sterilizer is self-contained with only visible Rota-meter, single valve control, and connecting lines outside cabinet walls.

**● AUTOMATIC GAS SHUT-OFF**

Gas instantly shut-off in case of water pressure failure thru pump fault or line leak.

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Gas flow starts and stops with pump.

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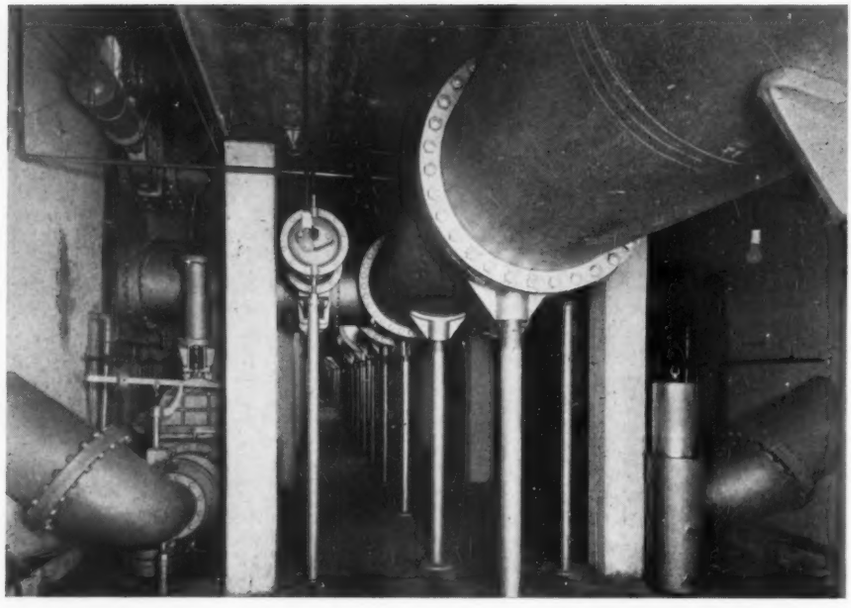

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# DISTRIBUTION SYSTEM MAINTENANCE AND REPAIRS

By HENRY E. NUNN

*Supt., Water District No. 1*
*Van Buren, Arkansas*

THIS subject covers a wide range of work and takes a considerable portion of the time of the average water works superintendent.

*The Author*

Handling repair work efficiently, demands, first of all, a thorough knowledge of the distribution system. This knowledge should be well recorded on maps and note books for ready reference. The foreman should be familiar with these records and be able to read a map.

When a repair is made it should be made as nearly permanent as possible. During the construction work it pays to follow up back filling after each rain until the ditch is permanently settled. It builds good will to keep the parkways cleaned up behind work.

Leak surveys are helpful. They cut down loss and save money on pumping. There is always a chance that a small leak which a little caulking would repair may increase to troublesome proportions or may even blow out a joint. When repairs are made that involve taking any main out of service, the fire department should be notified which streets are blocked and which hydrants are out of service.

### Service Work

A pipe pusher pays for itself in a short time. It is always wise to avoid cutting pavement whenever possible. A pipe pusher or block and tackle can often be used to an advantage in replacing old services by attaching a new copper or lead pipe to the old iron pipe and pulling it in place as the old pipe is pulled out. By avoiding pavement cutting, you minimize traffic interference, eliminate extra expense, and build good will.

When replacing old services, it is well to check up to see if the old tap is sufficient to meet the demands of the service. If not, time and expense can be saved by making a tap of the necessary capacity while the other work is being done. Replacing old iron services with copper or lead is always economical.

When meters are set in parkways, tight boxes should be used and they should be set high enough to keep dirt from sifting in through the cover and filling the box. All meters should be well below the frost line. A damaged meter means loss of revenue as well as expense of repair. A hole directly below the meter will help keep the box clean and will also keep the meter warmer in cold weather.

Trucks and service cars in good repair are a necessary part of maintenance. They should always be in the best possible condition.

A full supply of small tools should be kept in workable condition. A crew without adequate equipment is more expensive than a few wrenches and picks. Time and trouble are saved by keeping rubber boots on hand for the crew.

The most important thing in making repairs in the Distribution System is eternal vigilance. Frequent trips over the entire distribution system will keep up with its condition. When you drive about town and habitually observe the condition of fire hydrants and valves and watch for evidences of leaks, you are likely to be doing a good job of maintenance.

P. S.—A very important item is to read Water Works magazines and make a not of all "kinks" that other operators pass on.

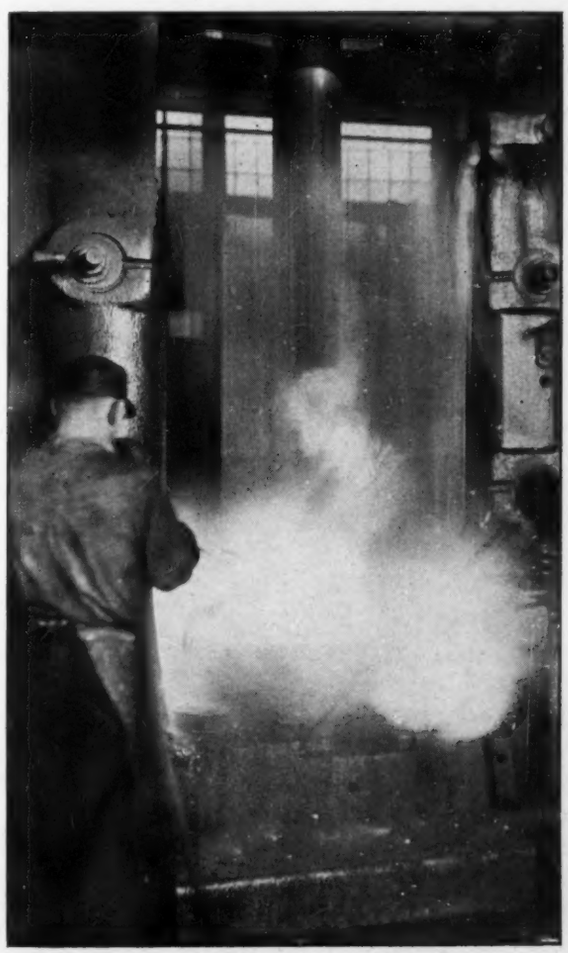
*Acknowledgment*—The above constitutes excerpts from a paper read before the Arkansas Water and Sewage Conference.

▼

## SPECTACULAR! A WALLOP OF BETTER THAN 8,000,000 POUNDS

Here is one of the largest drop hammers of its type at work. The total weight of the hammer is better than 265 tons and the falling weight is 22,000 pounds at 26.6 ft. per second, capable of striking a blow of 8,300,000 pounds—What a wallop! The foundation required is 41 ft. deep under the hammer—a concrete block 35 ft. thick topped by 12 x 12 in. timbers for 6 ft. to serve as the cushion.

This dramatic spectacle is a cut-out from the spectacular and educational Crane movie "Flow" which is subject to loan for showings at association meetings, upon request.



*A 265-Ton Drop Hammer at Work.*

**The Ward's Island Sewage Treatment Works of New York City**

*In the background of this aerial view is the portion of the Manhattan district served by the Manhattan interceptor, and in the right background is the Manhattan branch of the Tri-borough Bridge. The white highway in the middle distance is the main Tri-borough Bridge approach, and just in front of that is the Hell Gate Bridge of the New York Central Railroad. The Randall's Island Stadium is to the right of the little Hell Gate span of the two bridges.*

*On Ward's Island the square building next to the Hell Gate Bridge in the center of the view is the central heating plant. In front of that is the large pump and blower house. Immediately behind the pump and blower house and to the left of the central heating plant the two inverted syphons bring the sewage from Manhattan and the Bronx and merge, and are connected to the suction well of the pumps which lift the sewage against a head of forty-six (46) feet to the preliminary settling tanks, shown in front of the pump and blower house. The four small square buildings in front of the preliminary tanks are preliminary pumping stations which deliver sludge and scum to the sludge storage tanks, located in the large building on the waterfront, in the foreground. Immediately in front of the preliminary tanks are the four batteries of aeration tanks, followed by the four batteries of final settling tanks. The two rectangular buildings in the center of this group of tanks are the return sludge pumping stations, with their operating galleries. The view shows the waterfront dock, to which the sludge vessels tie up.*

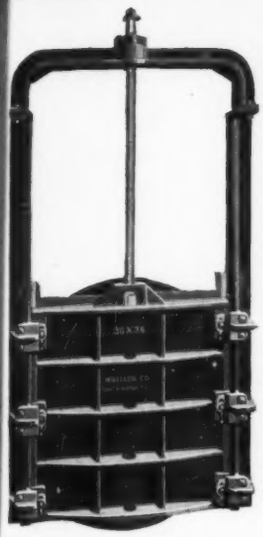
## LAUNDRY WASTE TREATMENT WITH FERRIC SULPHATE EFFECTS 87% B.O.D. REDUCTION

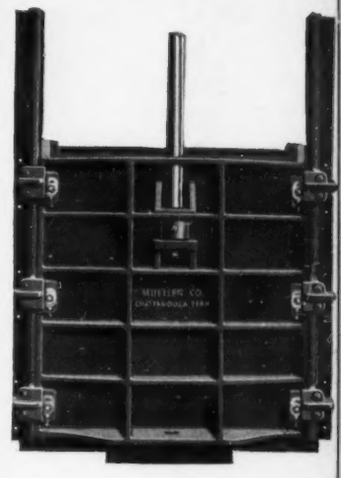
Studies at the Lawrence Experimental Station of the Massachusetts Department of Health, showed that laundry wastes discharged into small rivers during the warmer months of the year may deplete the dissolved oxygen to such an extent that offensive conditions will occur. Such wastes contain a relatively large amount of soap, which tends to clog filters. Tests at the Lawrence Station have shown that these wastes can be clarified and most of the objectionable organic matter removed by precipitation with ferric sulphate, and the sludge may be satisfactorily dried on sand beds. The average B.O.D. of a number of samples of these raw wastes was 390 p.p.m. After coagulation and sedimentation the clarified wastes had a B.O.D. of only 52 p.p.m., a reduction of about 87 per cent. This treatment converted the laundry wastes from very soapy turbid liquids to clear ones, which will not seriously affect the river during the warmer weather.

*Water Works and Sewerage—September, 1938*

# MUELLER
# COLUMBIAN LINE OF

## SLUICE GATES
## FLOOR STANDS
## GATE HOISTS
## SHEAR GATES
## FLAP VALVES
## MUD VALVES





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Not only does Mueller-Columbian fill regular requirements, but an engineering department is at your disposal to assist in the solution of any special problem and to recommend and provide the RIGHT equipment to do the job. Get in touch with Mueller-Columbian on your next water control project. Quotations and detailed information will be gladly furnished upon request.

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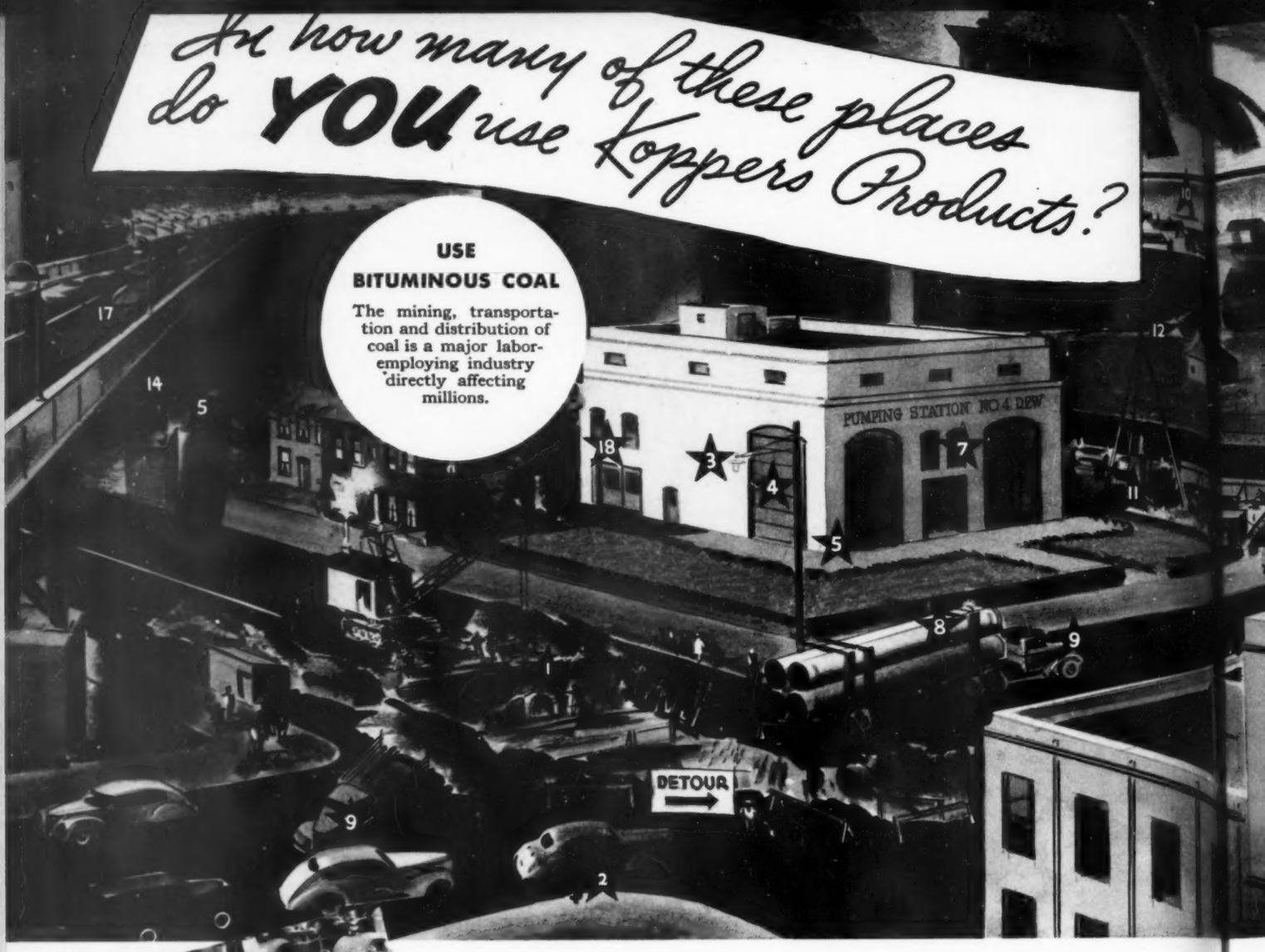
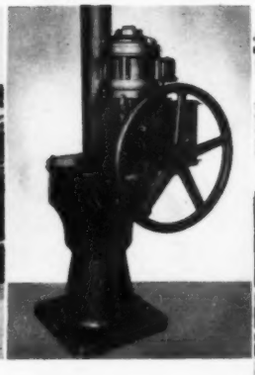


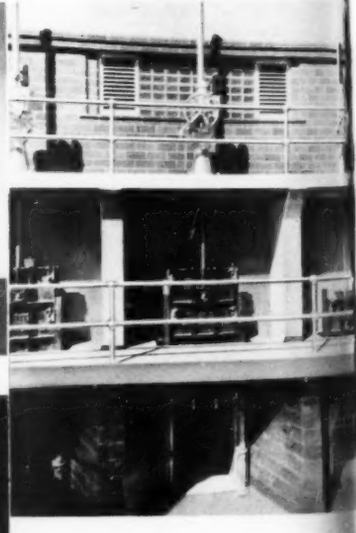
★1 WESTERN AND MICHIGAN VALVES

★2 FIRE HYDRANTS

★3 FLOOR STANDS

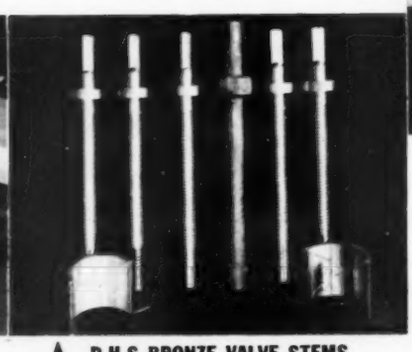


★4 SLUICE GATES



★5 WATERPROOFING AND DAMPPROOFING

★6 COAL TAR ROOFING

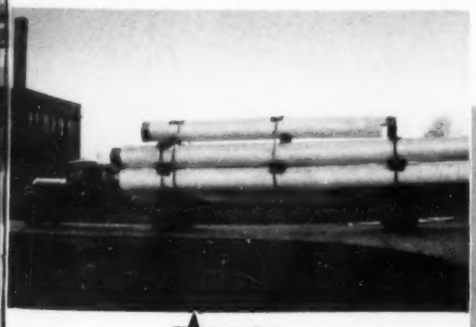


★7 D-H-S BRONZE VALVE STEMS, STEM NUTS, GUIDES, SEATS, etc.

*Drawn for Koppers Company by Alex Ros*

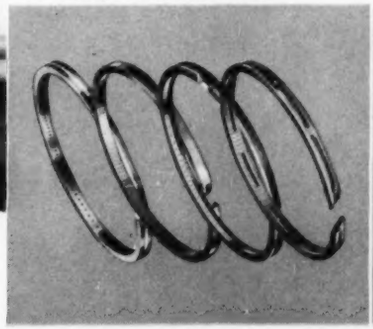
# KOPPERS

**12 Coal** **13 Bituminous-base Paints** **14 Lumino, Bituminous-base Aluminum Paint**
**15 Sewage Disposal Equipment** **16 Gas Holders and Dry Purification Systems**
**17 Tarmac Paving Tar** **18 Fast's Self-aligning Couplings**



**8 PIPE**

**9 AMERICAN HAMMERED PISTON RINGS**



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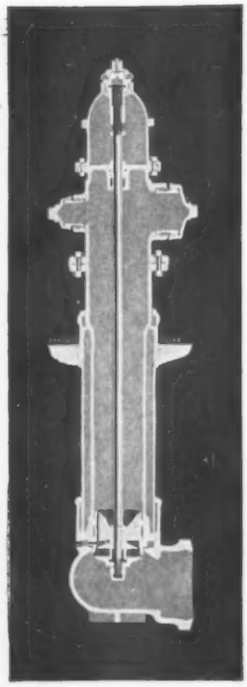

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# HIGH-RATE TRICKLING FILTER AT BEDFORD, IOWA

By C. MAXWELL STANLEY*
*Consulting Engineer, Muscatine, Iowa*

*The Author*

A HIGH-RATE trickling filter has been selected for the sewage disposal plant, now under construction, for Bedford, Iowa. The unit, designated as an "Aero-filter," will have a dosage rate of 30,000,000 gallons per acre per day. The factors entering into the selection of this equipment are outlined herein, together with a brief description of the plant. The high-rate filter has been selected because the performance guaranteed by the manufacturer will provide suitable treatment at a lower cost than that obtainable with a conventional design, and because such assured performance is backed by a bond which the City considers adequate protection.

Bedford, a typical county seat in agricultural Iowa, has a population of 2,100, with 85% of the community connected to its sanitary sewer system. As there is no tendency toward increased population, the plant has been designed for the present population, plus the wastes of two creameries and a small poultry packing plant. The wastes of these industries have a population equivalent of 550, making a total equivalent contributing population of 2,650.

The following table shows a summary of the expected sewage flows and the basis used for design.

| | G.P.D. | G.P.Hr. | G.P.M. |
|---|---|---|---|
| Dry weather | 105,000 | 6,550[1] | 109 |
| Infiltration | 145,000 | 6,050 | 101 |
| Wet weather | 250,000 | 12,600 | 210 |

[1]Dry weather flow concentrated in 16 hours.

The estimated maximum total B.O.D. is 450 lbs. per day. This maximum, however, is not expected to be reached for some years. On the basis of estimated wet-weather flow, this will give a sewage having a B.O.D. of 218 ppm. The normal suspended solids of the sewage is in the neighborhood of 300 ppm.

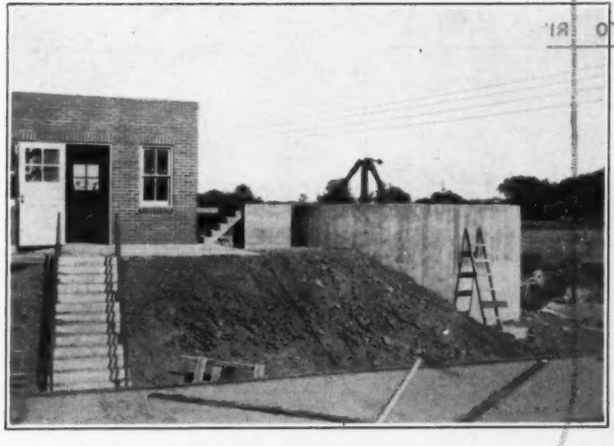
The effluent from the plant will discharge into the 102 River, which has a very unstable flow and at times is nearly dry, thus offering no dependable dilution.

*Young & Stanley, Inc., Engineers, Muscatine, Ia.

## Selection of Type of Treatment

The absence of flowing water to provide dilution makes necessary the use of a type of treatment which will give complete and reliable purification of the sewage. The size of the community places a definite limitation upon the operating costs which are permissible and works against the selection of any type of process requiring full time or expensive supervision. These facts limited serious consideration to trickling filters, and to activated sludge with mechanical aerators. The latter process was dropped from consideration due to relatively high local rates for electrical energy, and due to the fact that this process would require more constant and higher grade supervision.

A trickling filter plant, with separate sludge digestion, was therefore selected for the basic design. Studies and investigations of the possibilities of reducing costs, by employing high-rate trickling filters, resulted in the decision to request bids on such a design. Specifications and plans, accordingly, called for a base bid on a conventional filter and alternate bids on a high-rate filter, designated as an "Aero-filter" and making use of a novel distributor manufactured and licensed by the Lakeside Engineering Corporation.



*The Bedford Plant Nearing Completion (this picture reveals the relative size of the Aero-filter on the right. In the rear of the building are the clarifiers).*

*High-rate filtration in sewage and waste treatment has much to commend its consideration. Where tried to date, results from the process have effectively indicated its possibilities. Especially have the findings at the experimental plant of the Chicago Sanitary District revealed the potentialities of high-rate filters, operated for long and continuous periods and including winter and summer seasons, which is the only true test of any biological process. In treating such wastes as those from the milk products industry, high-rate filters have given a good account of themselves, as reported elsewhere in this issue.*

*The author of this article was requested to describe the Bedford, Iowa, plant, and to set forth the factors entering into the selection of high-rate filtration for a small community. In due time, when sufficient data has become available to justify it, Mr. Stanley has agreed to present something of the operating results and costs of operation at Bedford in a second article.—Ed.*

### Description of Plant

The general arrangement of the plant is shown in Figure 1 and a schematic flow-diagram is shown in Figure 2. A short inlet sewer connects the existing system to the plant through an inverted syphon under the 102 River. Sewage flows through the screen chamber, enters the wet well and is lifted to the primary settling tank by two motor-driven centrifugal pumps, one having a capacity of 100 gpm. and the other 200 gpm., each controlled by float switches. The primary settling tank is equipped with straight-line sludge collecting mechanism and provides a detention period of 2.2 hours on dry weather flow and 1.15 hours on wet weather flow. From the primary tank the sewage flows by gravity to the Aero-filter, which has an inside diameter of 24 ft. and a rock depth of 8 ft. From the Aero-filter the sewage flows by gravity to the secondary tank, which has a detention period of 2.2 hours on dry weather flow and 1.15 hours on wet weather flow, and is then discharged into the river. Provisions are made for the returning of filter effluent from the secondary tank to the wet well, from which the pumps will lift it into the primary tank. This recirculation is for the dual purpose of increasing the rate of application of sewage to the filter, if and when desired, and for the purpose of returning secondary sludge to the primary tank.

Sludge is drawn from the primary tank and a sludge pump forces it to the digester. Supernatant is returned from the digester to the primary tank. The digester has a capacity of 6,170 cu. ft. and is arranged for collection of gas, which is burned in a boiler that supplies hot water to heating coils in the digester. Digested sludge is taken by gravity from the digester to the sludge beds.

In the control-house are located the two sewage pumps, the sludge pump, boiler and gas burning apparatus, electrical control for all motors, and a small laboratory.

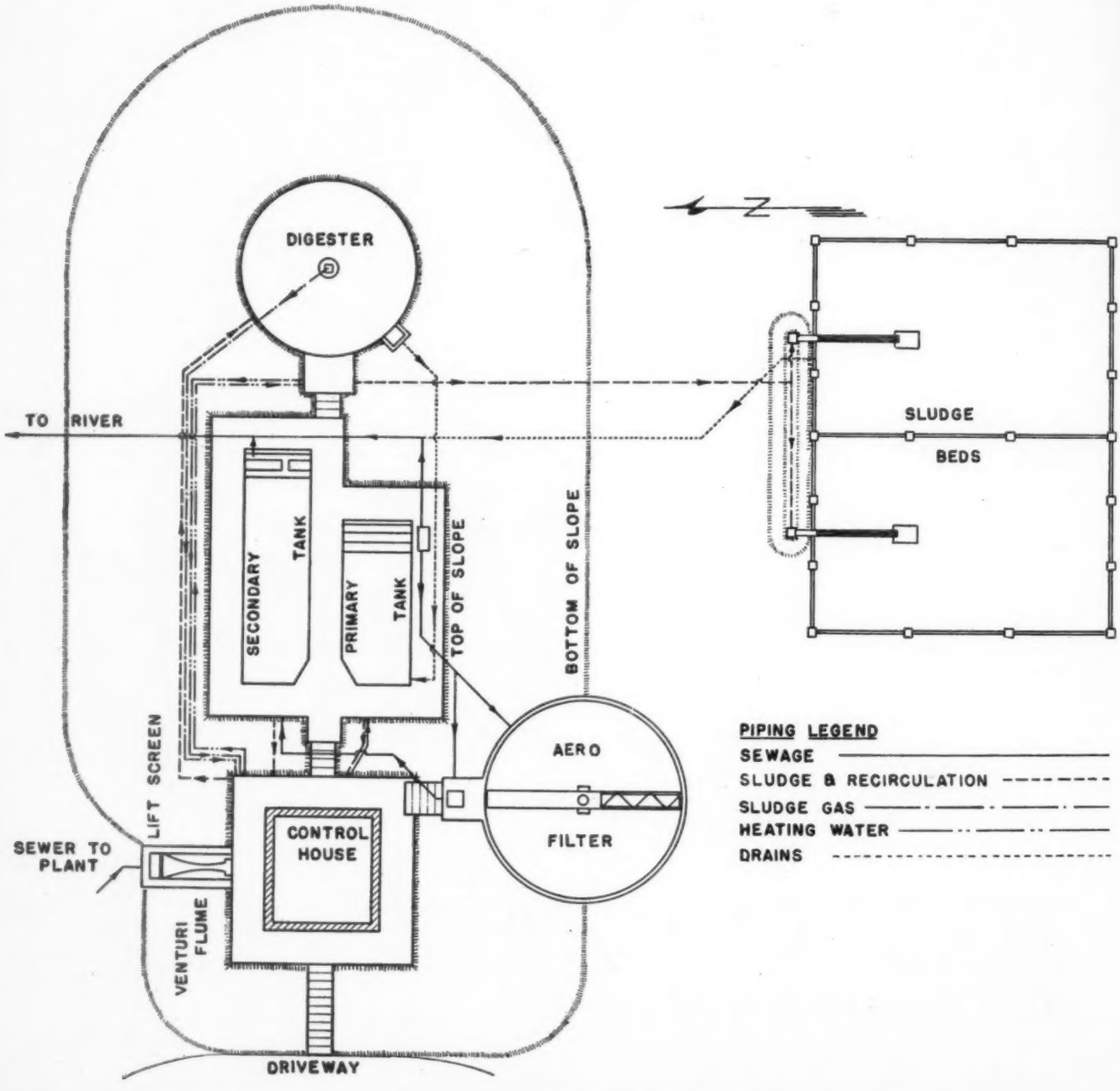



*Fig. 1—General Arrangement of Plant*

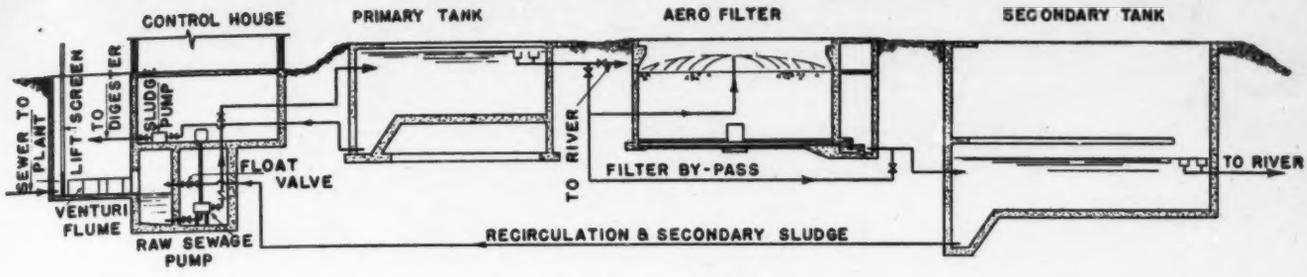



*Fig. 2—Schematic Flow Diagram*

## Comparison of Conventional and High Rate Filters

The following table shows the comparison of the principal design features of the conventional trickling filter and the Aero-filter chosen:

| | Conventional Filter | Aero-Filter |
|---|---|---|
| Diameter (feet) | 70 | 24 |
| Depth of media (feet) | 8.1 | 8 |
| Area (acres) | 0.0884 | 0.0104 |
| Acre feet | 0.715 | 0.083 |
| Maximum rate of dosage—(Million Gal./Acre/Day) | 4.2 | 30.0[2] |

It is readily apparent that the difference in physical dimensions between the conventional and Aero-filter are startling.

The cross section of the Aero-filter is shown in Figure 3. The distributing mechanism is of the rotary disc type, powered by a ½-h.p. motor. This mechanism operates continuously when the filter is in service and sprays the sewage over the entire surface of the filter to effect a rain-like application.

The underdrains are of the flat block type. These cover the entire floor and connect to a collection gutter, on the center line of the unit, which runs toward a manhole at one side. The bottom of this manhole is designed to provide a water seal so that air may be drawn through the under-drain system and the filter media, at times, when the difference between air and sewage temperatures is insufficient to provide suitable natural draft. A circulating fan, having a capacity of 452 cfm., is used for this purpose and is driven by a 1/6-h.p. motor.

In adapting the Aero-filter to the plant, it was necessary to enlarge the secondary settling tank, but no other changes were required. The recirculating system had already been adopted for use with either the conventional or high-rate filter.

## Guarantees

The specifications required guarantees on the performance of the Aero-filter. The guarantees submitted by the Lakeside Engineering Corporation, manufacturer and licensee of the distributor, are as follows:

1. The effluent, from the final settling tank, will have an average maximum B.O.D. of not to exceed 25 to 30 parts per million, and an average suspended solids of not to exceed 25 to 30 parts per million, based on a raw sewage having a maximum B.O.D. of not to exceed 250 ppm. and a flow through the filter of not to exceed 13,000 gal. per hr.

2. Guaranteed power consumption of the motorized distributor will not exceed 0.4 h.p.

3. Guaranteed power consumption of the ventilating fan will not exceed 1/6th h.p. for a maximum of six months per year.

The guarantees provide, further, that if the equipment does not meet the requirements set forth above, the manufacturer will make all necessary changes, at his own expense, to bring the plant performance up to meet the guarantees. It also provides that if the power consumptions are in excess of those guaranteed, an adjustment will be made on the basis of the difference in expected power consumption over a 10-year period, using the present cost of electrical energy. The fulfillment of all guarantees is to be determined by the Iowa State Board of Health. The guarantees are backed by a bond which the city considers adequate.

[2]Based on guarantee flow of 13,000 gal. per hour.

## Comparative Costs

Consideration of comparative costs involves both first cost and operating costs.

As bids were received on both a conventional and high-rate filter, a direct comparison is available for first cost. The difference is shown by the following table:

| | | |
|---|---|---|
| Actual bids in difference as received | | $6,300.00 |
| Less cost of increasing secondary tank | $998.98 | |
| Less license fee on Aero-filter | 751.15 | 1,750.13 |
| Net saving in first cost of Aero-filter | | $4,549.87 |
| Per cent saving—13.8% | | |

The determination of the difference in operating costs is naturally more difficult. Consideration can be confined to differences in power consumption as the costs of supervision, maintenance, etc., will not vary appreciably between the two types. The differences in power consumption arise from three sources, as indicated below:

1. Increased consumption required for the distributor on Aero-filter over a motor-driven rotary distributor which had been adopted from the conventional filter. This increase will be the difference in electrical energy required, based upon the guarantee power consumption of 0.4 h.p. on the Aero-filter as compared to the consumption of approximately ⅛ h.p. for the conventional filter. Assuming continuous operation such amounts to 1,800 kwh. per year.

2. Power for the operation of the aerating fan. This is determined from the guarantee consumption of 1/6th h.p. for six months in the year and amounts to 550 kwh. per year.

3. Power consumption for increased operation of sewage pumps to provide recirculation. It is almost impossible to determine actually the power that will be required for this purpose, but it is believed the amount can be approximated by computing the extra power costs for recirculation, based upon average daily design-flow. This is partially offset by the power that would be required to pump sludge from the secondary tank and by the fact that it was planned to use recirculation on the conventional filter at times of low flow to improve conditions in the primary tank. Taking all of these factors into consideration, we have estimated that the increased power for the recirculation will not exceed 4,050 kwh. per year.

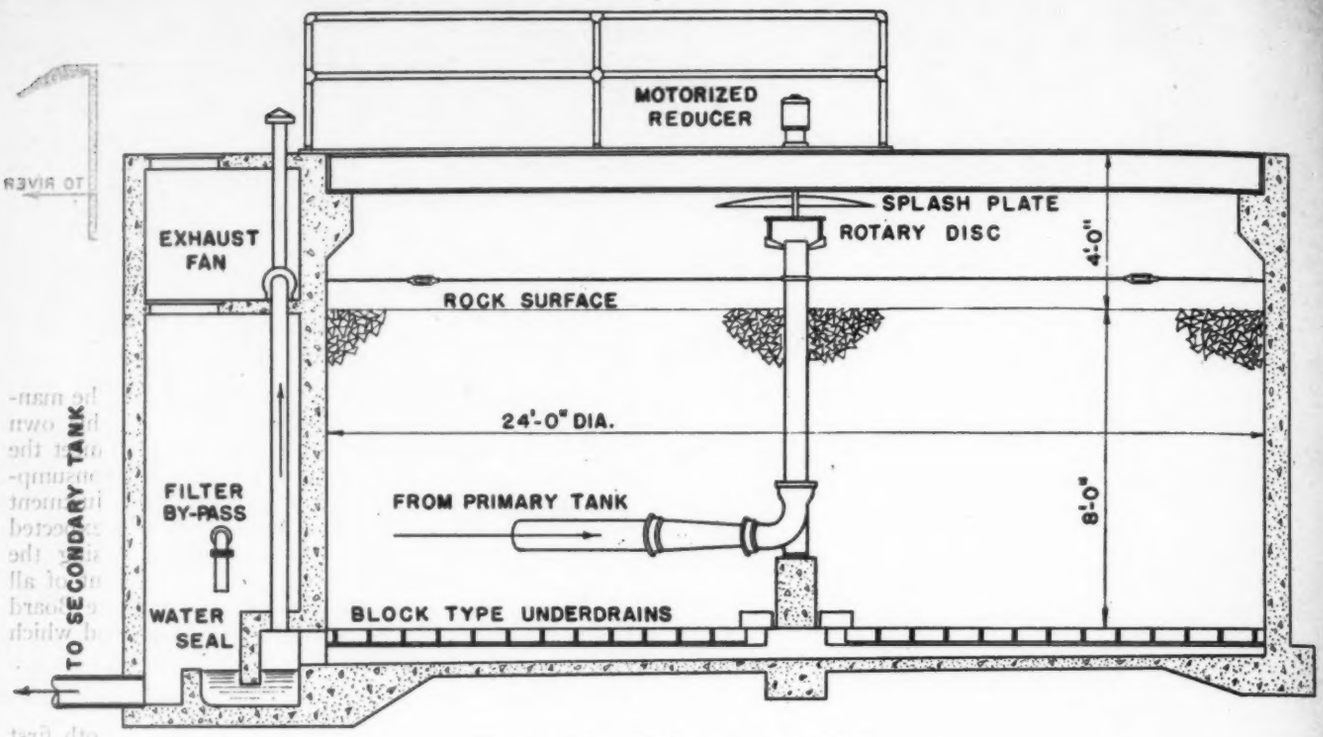



*Fig. 3—Cross Section of Aero Filter*

A summary of the expected additional power costs is as follows:

| | kwh. |
|---|---|
| 1. Distributor | 1,800 |
| 2. Fan | 550 |
| 3. Recirculation | 4,050 |
| Total | 6,400 |

At the prevailing rate of $0.0225 per kwh., this will mean an increased cost of $144 per year, which is equivalent to only 3.2 per cent on the difference in investment between the two types of plant, which percentage is insufficient to cover the usual fixed charges.

In summary, it may be stated that in this particular case, the saving in construction cost amounts to approximately 14 per cent as compared to a conventional filter, and the increase in operating costs is estimated at not to exceed $144 per year.

### High-Rate Filtration

The interest of engineers in high-rate filtration is readily understandable. The cost of a trickling filter, or other device, to treat the sewage after it has passed through the primary settling tanks, comprises a very considerable part of the total cost. The desire to increase rates of application of sewage to trickling filter is an expression of a wish to decrease the cost of sewage treating plants. The experimental work of Halvorson, the Chicago Sanitary District, and others, in recent years, has indicated that high-rate of filtration can be used, *provided the rate of dosage is increased sufficiently*. Such high rates of application, if satisfactory, will not only decrease first costs, but will eliminate some of the problems of ponding, flies, etc., which are often present with conventional trickling filters. The use of high-rate filters is not tried and proven, but their success is indicated in the results from the considerable experimental work that has been conducted.

A high-rate filter has been selected at Bedford, Iowa, because it is guaranteed and bonded to provide, at lower cost, results substantially equivalent to those obtainable with an ordinary trickling filter.

The operating results of this plant will be interesting as they will demonstrate whether or not high-rate filters can perform satisfactorily under the conditions prevailing in this plant.

### Acknowledgments

The Bedford, Iowa, project is being constructed under the direction of the city officials of Bedford, Iowa, with Mr. John S. Nevius, Mayor, and Mr. H. E. Nelson, City Clerk. The plant is being financed, in part, by a grant from PWA. The general contractor is Arthur F. Mathis, of West Des Moines, Iowa. The project has been designed and its construction is being supervised by Young & Stanley, Inc., Engineers, Muscatine, Iowa.

▼

## PHILADELPHIA BEING FORCED TO TREAT ITS SEWAGE

Against Philadelphia, the State Department of Justice has been asked to take court action to compel the city to treat its sewage which now grossly pollutes the Deleware and Schuylkill Rivers. The action is being taken by the State Sanitary Water Board under the new Pennsylvania anti-pollution law. Since the new law (LaRue Bill) recognizes no plea of poverty as excuse for continuing pollution, it would now appear that, after many years of such pleading as an excuse for lagging behind in sewage treatment, Philadelphia must now do something else.

The new law is made enforceable due to the fact that it is now legal for Pennsylvania municipalities to issue bonds of the non-debit revenue type and charge sewer rentals to provide interest and take care of amortization and operation of sewage systems and treatment works.

It has been estimated by John H. Neeson, Chief of the Bureau of Engineering, that Philadelphia must spend about $64,000,000 to provide adequate treatment for the entire sewage of the city, if the court action is effective.

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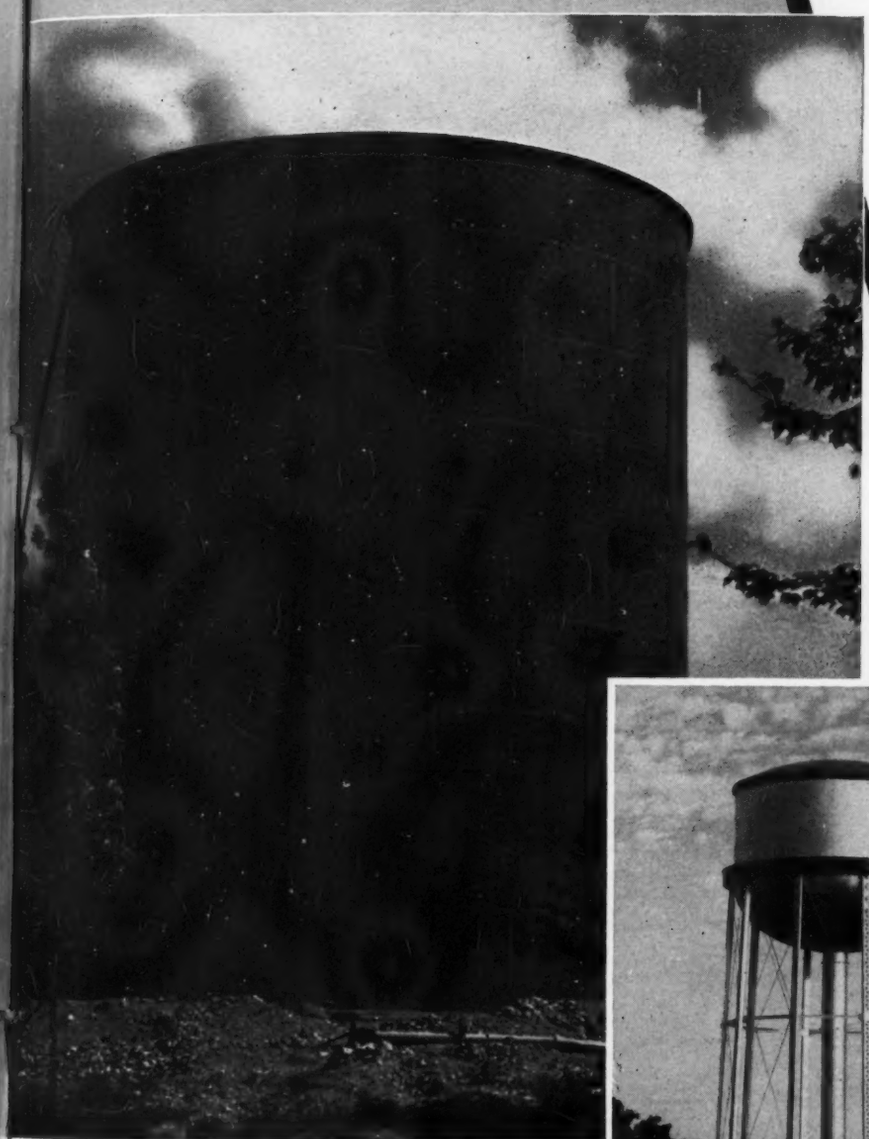

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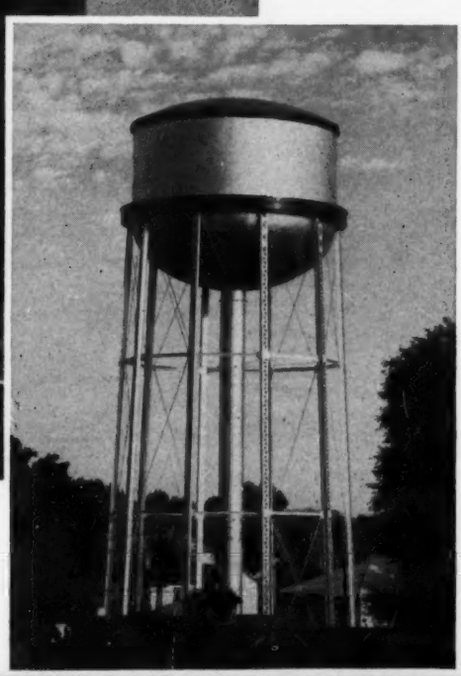

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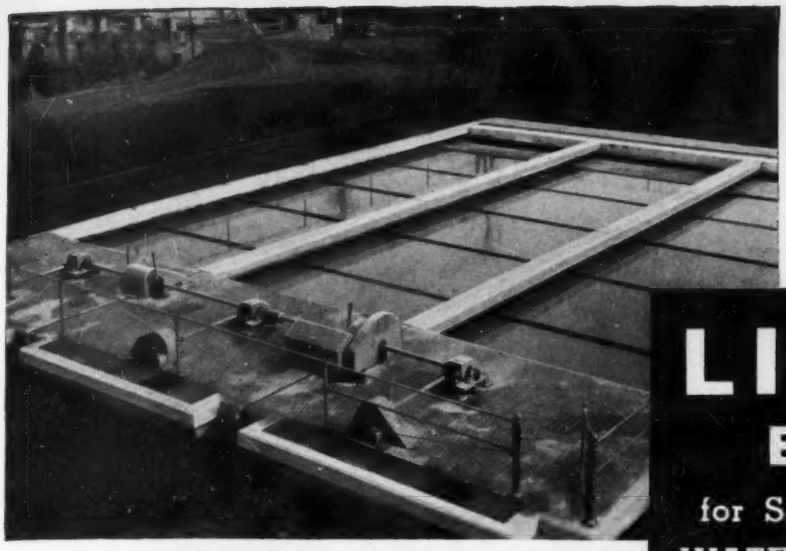

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A general conference session will cover such subjects as "Preparing the Plan", "How to Gather Usable Material", "Copy Technique", "How to Sell Management", "Co-ordinating Sales and Advertising" and "How and Why to Use an Industrial Agency."

Another session will deal with "Problems of the Small Advertiser", "Production Problems", "Public Relations"—and there are many others.

If I were an Advertising Manager, I certainly would start now to make plans to attend the 16th N. I. A. A. Conference even if I had to hitch-hike to Cleveland. And I would send in my advance registration now to—Ed. Bossart, Bailey Meter Company, Ivanhoe Road, Cleveland, Ohio.

**IF I EMPLOYED AN ADVERTISING MANAGER**—I would make certain that he attended this Conference, because changing times and markets demand a changed viewpoint—a new viewpoint that can be obtained only by hearing discussions by men whose experience is up-to-the-minute—right up to September 21st.

NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION

100 EAST OHIO STREET • CHICAGO, ILLINOIS

# LONG ISLAND OPERATORS MEET AT RIVERHEAD

*Glistening Wall Piece*
*(Hanging on the laboratory wall are these chromium plated tools used by the mayor in ground breaking.)*

AT RIVERHEAD, L. I., the Long Island Section of the New York State Sewage Works Association held another of its worthy quarterly meetings on July 9th.

Riverhead was chosen for this meeting in order that it might show off its new spic-and-span treatment works. At the close of the technical session, during which the design of the plant and operating results were discussed, the plant was inspected. Following this, the usual dinner was held.

In accord with custom, the master of ceremonies was the local superintendent of sewers, George C. Welch, who introduced Chairman Joseph V. Kelly, Fred C. Boucher, Austin H. Warner and Henry M. Zaleski, members of the Board of Commissioners of Riverhead Sewer District, and other "head tablers," including Fred J. Biele, president of the N. Y. S. S. W. A. and Chas. C. Agar, immediate past-president of the association.

The dinner meeting came to a close at an hour which allowed all attending to drive home, after voting the next quarterly meeting to Great Neck, L. I. in September.

## Technical Session

(Sec'y L. L. Luther, Presiding)

**"The Design and Construction of the Riverhead Plant"**—by FRED J. BIELE, Consulting Engineer, Huntington, L. I.

Mr. Biele briefly described the new plant, designed for a population of 6,500, which employs the activated sludge process. He also reviewed some of the design problems in re-arranging the sewer system of Riverhead, which necessitated lifting some of the sewage three times in order to make use of shallow sewers and existing flat grade sewers. He emphasized the water tight construction, as evidenced by remarkably low leakage tests, and also the fact that the normal flow amounts to only 45 gals. per capita or less. Strength of sewage and septicity were the chief problems which had to be contended with such low flows, flat and tight sewers. The plant, designed for 600,000 g.p.d. flow (based on state requirements of 100 gals./capita capacity), provides screening, primary sedimentation, aeration in a battery of 6 mechanical aerators of American Well Works type, final clarifier, and pre and post chlorination. Wasted sludge is delivered to the crude sewage and the mixed sludges are digested in open unheated digestion tank. Digested sludge is air dried on open beds.

**Riverhead Notables**

*Justices F. H. Boucher and A. H. Warner (Sewer Commissioners) Flank Fred Biel, President of the N. Y. Sewage Works Assn. and Cons. Engr., Huntington. (On the bronze plate behind him, his name appears.)*

*Prime Mover*

*L. L. Luther, Mgr. Freeport's Dept. Sanitation (Organizer; Secretary)*

*Nassau Co.'s New San. Engr.*

*J. L. Barron (Mincola) (Westchester's Loss; Nassau's Gain)*

**Herbert L. Schwartz,** American Well Works, New York City, who was pinch-hitting for the scheduled discussor, J. Donald Walker, Engineer of the same company, was asked to describe the unique American aerator. This he did very effectively by explaining that, unlike most mechanical aerators, it operated on the down-draft principle of emulsification of entrained air. An impeller rotates in a down-take tube at tank center and, therefore, creates no splash or spray. Driving the mixed liquor downward at a velocity of 8 ft./sec., to mushroom outward at tank bottom, it rises uniformly to the surface. The entrainment of air takes place in the down-draft tube into which drop multiple streams of the liquor through 5/8-in. slots in the tube collar. Normally the drop is 1 foot (water surface in the aerator to that in the central well) during impeller

**At the Riverhead Plant**

*(1) From Mineola—Varnum (Commissioner); Hall (Plant Supt.); Downs (Supt. Public Wks.); (2) From Cedarhurst—W. J. Hogan (Plant Supt.); Eugene Lehr (Associate, H. McLaughlin, Engr. Cedarhurst); Chas. Kirsner (Operator); (3) Battery of 6American Aerators with Laboratory and Chlorination Bldg. behind; (4) From Glen Cove—H. N. Williams (Supt. Sewerage); John F. Lange (Commissioner of Public Wks.); F. Miller (Plant Operator); (5) Chas. C. Agar (State Dept. Health) does a little sketching for Lehr, Hogan, et al.*

operation. The contents of the tank are turned over theoretically every 20 minutes. At Riverhead three tanks are operated in series, there being two such 3 tank batteries in parallel. Mr. Schwartz said that the efficiency in oxygen utilization seemed to be due largely to the very effective emulsification of the entrained air, which received increasing compression to a maximum at the bottom of the down-draft tube. An interesting

*Geo. W. Welch, Supt. of Sewerage, Riverhead, L. I. (Host and Master of Ceremonies); R. C. Corwin. Operator, Riverhead, L. I. (had a hand in producing "Cookie's Cocktail"); Wm. T. Carpenter, Chemist, Dept. Sanitation, New York City. (Veteran Sewage Chemist of many administrations who has seen New York abandon chemical treatment; return to chemical treatment)*

claim was that the American aerator allowed variation of air input without changing the power consumed per million.

Mr. Biele added that each aerator was equipped with a 2-h.p. motor. There being six units designed for 600,000 g.p.d., meant a 20 h.p. per m.g. designed power consumption.

**"Operating Experiences at Riverhead,"** by RODNEY E. COOK, Sanitary Engineer for Suffolk County, Riverhead, L. I.

Mr. Cook in reviewing operating experiences at Riverhead, commended those in charge of operating the plant and made it plain that plant performance had been in direct proportion to the brand of operation which had been in force during the life of the plant. Having experienced difficulties and sporadic operating attention, present performance (as viewed by the visitors) was a reflection of operator ingenuity, diligence and pride.

The plant had been in continuous operation providing activated sludge treatment since February, 1938. The low water consumption of 45 gal./capita had been responsible for a sewage stronger than desired for mechanical aeration. Worse than this had been the staleness (at times septicity) of the sewage. Only continuous sewer flushing had corrected these evils in warm weather, with chlorination at the lift stations contemplated to stay the troublesome septization. Another difficulty had been the attempted wasting of supernatant digester liquor to the crude sewage. The primary settling period of 8 hours under present loading of 100,000 g.p.d. (1/6 plant design loading) was admittedly a detriment in increasing the septicity of the sewage. The secret of effective operation had been found only after considerable trial and reducing the ratio of returned sludge to that which made it possible to maintain at least some dissolved oxygen at all points in the three aerators now in service, and to hold the pH

**Producer and Consumer**

*John Victoria, Chief Operator, Riverhead, L. I.; Rodney Cook, Nassau Co. San. Engr., Riverhead, L. I. (Much praise went to Operators Victoria and Corwin for excellence of plant performance and effluent. To prove the last, "Cookie" said he wouldn't mind taking a drink—and, by gum, he did!)*

of the mixed liquor between 7 and 7.2. The maximum permissible suspended solids in the mixed liquor had thus been found to be 600 parts per million rather than the 1,000 parts recommended. The addition of lime had been necessary to maintain a pH value at 7 or slightly above in the aerators. It has been necessary to discontinue bleeding supernatant from the digestor to the crude sewage, and to consign one sand bed to its handling. With only the three aerators in service (½ the plant capacity), careful control of sludge return,

*(1) Luther, Varnum, Barron, Bidwell, et al.; (2) "A man with a strawhat," Shapiro, Agar; (3) Groups inspecting American Aerators; (4) McKeeman (Freeport), Ketcham (Port Jefferson), Sammis (Brentwood), Sutherland (Freeport), (5) Hogan, (Cedarhurst), Klinck (Lawrence), Lahr (Hempstead).*

(1) *Milton Abrams, Wales Dove-Hermiston Co., New York City;* (2) *Paul Marrs, Operator, Pilgrim State Hospital, Brentwood, L. I.;* (3) *Charles Kirsner, Operator, Cedarhurst, L. I.;* (4) *Edw. Schaefer. Operator, Atlantic Beach, L. I.;* (5) *L. A. Sammis, Chief Operator, Pilgrim Hospital Plant, Brentwood, L. I.;* (6) *Arthur Rulon, Engr. Mather Hospital, Port Jefferson, L. I.;* (7) *H. L. Schwartz, Distr. Mgr., Amer. Well Works, New York City.*

plus systematic sewer flushing, the plant was now providing highly satisfactory purification of 1/6th the design capacity. In proof of his contention as to effluent quality gold fish were now being kept in the effluent and in further proof, Mr. Cook taking a "swig" of the effluent, said—"And, it doesn't even taste salty."

*It's Really So!*

*Robert Shapiro, Biologist, Ward's Island (N. Y.) Plant. (Looks at an effluent full of gold-fish at Riverhead's plant.)*

*Half of Mineola Came!*

*It was Frank Hall, Supt. Mineola's Activated Sludge Plant. (He listens to a speaker say that Riverhead's effluent is better than Mineola's. Is zat so! says Frank.)*

**Chas. C. Agar,** Senior Sanitary Engineer, State Department of Health, Albany, N. Y., said that if there was ever proof that good operation was the keystone to good plant performance, Riverhead experiences supplied such proof. Only by close observations had it been established that sludge return to provide no more than 500 to 600 p.p.m. suspended solids in the mixed liquor was an essential. The value of dilution and fresher sewage had been well established through the sewer flushing procedure. Likewise, following rainy weather, plant performance had automatically improved, thus stressing the seriousness of septic sewages in the activated-sludge process.

In explanation of difficulties with sludge digestion, it had been found that lime added to the digester had concentrated in the sludge proper, to produce a caustic reaction in the sludge zone, although the supernatant had digested only 6.9 pH value. Here was proof of the necessity of recirculation of digester contents for proper application of lime.

**L. H. Enslow** pointed out that difficulty with septic sewage was one of the chief problems at activated sludge plants all over the country. He said that it would be a fortunate operator who might be able to turn a convenient creek or branch into his sewers at will. In explanation of the cause of lower efficiency due to septic sewage, Mr. Enslow referred to the recent disclosure of the N. J. Experimental Station that septic sewage could not dissolve as much oxygen as fresh sewages. More important was the fact that a sewage diluted 1 to 1 with water, automatically had twice the oxygenation capacity because there was twice the volume of oxygen carrier for each pound of oxygen consuming material present. Unfortunately, the more septic and the stronger the sewage, the less the weight of sludge return permissible and the greater the necssity for rapid recirculation of a thinner, more diluting liquor, with less oxygen-hungry solids therein. In lieu of controlled dilution of sewage, the expedient of up-sewer chlorination had been found helpful as had the practice of chlorinating returned sludge. In one or two cases heavy chlorination of returned supernatant liquor had proved helpful.

*Frank Klinck, Chief Operator, Lawrence, L. I.; Wm. R. Alsdorf, Supt. Public Wks., Highland Falls, N. Y.; (Found L. I. flat—but not Riverhead's Plant); "Bill" Highberger. Mathieson Alkali Wks., N. Y. City. (The cigars were on him—also the secretray's joke.)*

At this point the meeting adjourned for the inspection of Riverhead's plant—the first in the East to employ American aerators.

(1) *M. J. Coffee (Freeport Commissioner); Raymond Whittaker (Supt. Nassau County Hosp., Farmingdale) and Friend;* (2) *Robt. Shapiro (Ward's Island, N. Y., Plant) and Harry Faber (Research Chemist, The Chlorine Inst., N. Y. City);* (3) *Groups at the Riverhead plant;* (4) *H. L. Schwartz and T. L. Ennes (American Well Works, Chicago);* (5) *Geo. Welch (Supt. Sewerage, Riverhead); Prof. C. T. Schwarze and Labian LeFebvre (N. Y. Univ.).*

*A Portion of the M & E Library (This View Shows the Stack Formation.)*

# MAINTENANCE AND OPERATION OF AN ENGINEERING LIBRARY

By RUTH CANAVAN

*Librarian*
*Metcalf & Eddy, Consulting Engineers, Boston*

SINCE an engineering library represents an overhead expense it must be maintained and operated in as economical a way as is consistent with the giving of good service. Good service consists in making the material available to all members of the staff as promptly and readily as is practicable.

The library of Metcalf & Eddy has been a "going concern" for some twenty-five years. It is housed for the most part in glass-front Globe Wernicke cases in stacks arranged back to back, which form the four sides of a rectangle. Within this are the library table and chairs, the librarian's desk and the card catalog. One side of the rectangle forms an aisle outside the partners' office, one end faces the entrance area, while the other end and side form part of the large drafting room. This arrangement makes possible very ready access to the material by all members of the staff. From time to time the advisability of a charge system (whereby a slip is left with the librarian for material removed from the shelves) has been discussed. But as measured against the occasional annoyance and loss of time in tracing down material which has become buried or mislaid, the charge system has not seemed practicable. All members of the staff have the privilege of taking material for use in the office without signing up for it, but if it is desired to take anything out of the office, a slip is left with the librarian. All material is supposed to be returned as promptly as possible, not to its place, but to two "return shelves" from which the librarian returns it to its proper place.

### Arrangements on Classified Basis

When many years ago the library was to be installed, consideration was given to the advisability of a classified versus an alphabetical arrangement of the material. The classified was decided upon. Experience has proved this to be the more practicable. Attention was also given to the best method of indexing. The Dewey system was considered, as were also the schedules then in use in various scientific libraries. At that time the Library of Congress engineering index had not been developed. A schedule was worked out, which in principle is similar to that of the Library of Congress, whereby the main classifications have alphabetical, and the subdivisions numerical designations, the latter extending into decimals. To illustrate, H is the designation for Civil Engineering, K for Water Works, N for Sewage Treatment and Disposal, P for Mechanical Engineering, etc. N (Sewage Treatment) is developed somewhat as follows:

N-0. Quantity of Sewage
1. Quality of Sewage
.0 General
.1 Methods of analyses (see also B and C) etc.
10. Ultimate disposal
.0 Dilution—general principles
.01 Streams
.02 Lakes
.03 Ocean and tidal estuaries, etc.

Recent developments in certain fields have necessitated a revision of the original indexing schedule. Also some flaws which developed during its use have been corrected. For instance, originally Refuse Disposal was treated as a subdivision of L, Sanitation and Public Health, but has now been made the main division S. This is not wholly due to development in the field of refuse disposal, but in large part to the large amount of material on this subject which the firm has accumulated. The field of sewage treatment also has changed and developed radically since the first schedule was made and has required complete revision of its indexing.

It is typical of the small library that it has to care for a great many different classes of material. There are the textbooks, the periodicals, the reports to clients, the computations, the municipal and state reports, government documents, files of data, catalogs, reprints, photographs, negatives and lantern slides.

### Textbooks

Textbooks are arranged according to the classifications of the indexing schedule, and receive several cards in the card catalog. There is an author card which covers author, title, edition, date, publisher and price, and on the back the key word to all other cards on the same book (title and subject or subjects). There is also a shelf list for the textbooks, the cards being arranged according to classifications, just as are the books. This has been found necessary in order to check up lost ma-

terial. There is a title card and also one or more subject cards. The data on these are brief, the author card being the principal informative card in each case. Originally author and title-subject catalogs were kept separate, but now have been thrown together and found more usable.

### Reprints

Reprints are bound in Gaylord pamphlet binders. At the beginning of several of the main classifications there is a series of such binders designated by the classification and a Roman numeral volume number, as N-I, N-II, etc. The contents are cataloged with the textbooks and in the same way.

### Computations

Computations are bound in a specially designed cardboard folder, by means of screw posts. These folders are made up by the bookbinder in four sizes, i.e., ¼-inch, ½-inch, 1-inch and 1¼-inch wide backs. The pages are numbered with a numbering machine and they are indexed by a typewritten sheet in the front either page by page or by groups of pages with tab sheets between, as directed by the staff member who turns in the sheets. The computations are numbered according to a job number, which has been assigned by the bookkeeper when the job was authorized. This number appears on the back of the volume, with a volume number and the date. The computations are cataloged alphabetically by job title and also in a consecutive numerical list.

### Reports

Reports to clients are filed in several stacks of glass front cases. They are numbered chronologically and are cataloged alphabetically on cards and also chronologically on typewritten sheets. For many years the office copy was bound in dark red buckram with the number in gilt on the back, but recently an attractive heavy cardboard cover has been adopted, with the number on a small round Dennison tag attached to the binding staple with a clip.

### Periodicals and Magazines

Most of the periodicals are bound, but a few are kept in unbound form and still others are discarded at the end of each year. Certain of the periodicals are abstracted. A chart is kept and the issues checked off after they have received attention. Abstracts are arranged on loose leaf sheets classified so that after remaining in a temporary binder for some days on the library table they may be removed to the corresponding volume in the data file. The periodicals are cataloged in the general card catalog file with the textbooks. Under "Reference Books" a short discussion will be found about the necessity for a good periodical index in the library.

### Municipal Reports

Municipal and state reports are arranged in two separate files, each running alphabetically according to the municipality or the state. Each has its own card catalog. The notations under some places are so voluminous that they are subdivided somewhat as follows: New York City, Sewerage and Sewage Disposal; New York City, Miscellaneous Reports; New York City, Water Reports, etc. The material, too, is voluminous to handle. Experiments have been made with red tape, pamphlet boxes, binders, and recently the very satisfactory method has been developed of cutting down letter folders to the depth of the shelf, and attaching by hinged tape a tab on which a typed designation can be pasted.

Government documents are housed in two stacks of glass front cases, arranged by departments or bureaus, as Census Bureau, Dept. of Agriculture, Public Health Service, Weather Bureau. They are cataloged in the main card catalog under United States . . . followed by the Department or Bureau designation.

*The Location Plan Above the Librarian's Desk. (Kept Up-to-Date.) This Very Helpful Guide, Showing Stack Numbers and Current Locations of the Major Classifications of Material, Saves Much Time for Librarian and Library User.*

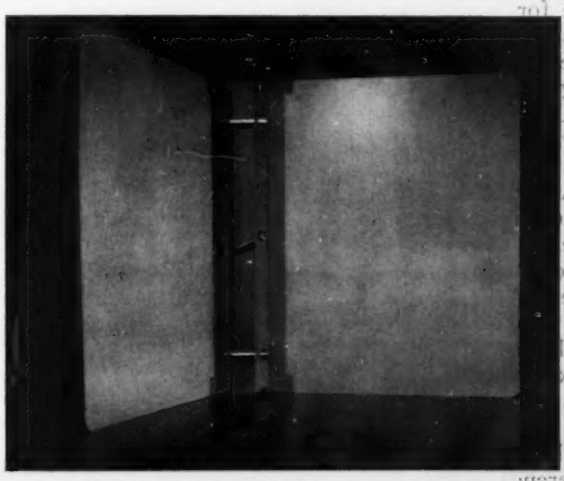
### Patents

Patents are filed in ring books according to the patent number, or in the case of foreign patents chronologically in separate volumes. Canvas covered ring books such as are sold at Woolworth's are used for these. Strips of surgeon's tape across the back serve as labels on which the inclusive patent numbers are placed. These volumes are housed in drawer units. A section of the main card catalog is devoted to "Patents," and there are two divisions, one according to patentee and the other according to subject. The assignees are also carded in with the patentees.

Similar ring books are used for filing data. These are for the most part in loose leaf sheet form, though typewritten reports on various subjects are included. This material is not cataloged or even indexed but is filed by classification.

### Trade Catalogs

Trade catalogs, of which there are several stacks, and which are used perhaps more frequently than any other material in the library, are filed according to classification on open shelves in letter folders. They are arranged



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alphabetically by manufacturer within the classification. They are cataloged in a separate card file by manufacturer. A subject index would be ideally desirable, but it would run into so many cards and its limitations would be so difficult to define that only a comparatively few blue cards with subject references or trade names of materials have been included in the file catalog. The indexing schedule had to be modified for application to the catalog file on account of the comprehensive character of the material indexed in many single catalogs. Hence in the Catalog Index, K 5.2 denotes Pipe and Valves, though in the main index Pipe would be K 5.210, and Valves K 5.3 under K 5.2 Distribution System. For the most part, however, the designations are the same in both schedules, and in all instances they have been made to conform.

### Photographs and Lantern Slides

Photographs are mounted on loose leaf sheets with photo tissue and the use of an electric pressing iron. The sheets are filed alphabetically *by place* in classified volumes, and have not needed cataloging.

Negatives are numbered chronologically, cataloged by place, and filed chronologically in large flat wooden boxes with partitions the width of the ordinary negative envelope. Enlargements fall under the same chronological numbering, but are filed in large envelopes.

Lantern slides are numbered chronologically and are filed in wooden slide boxes with the inclusive numbers on both ends. They are cataloged in a loose leaf book of typewritten sheets, the front half being a chronological listing and the last half having sheets arranged by place, with several under the heading "Miscellaneous." It has been found useful to keep a record of the slides used for the various talks as given, for future reference in making up lists of slides for other talks.

### Reference Books

Among those most useful in an engineering library of this character are the following: World Almanac, Professional Societies Year Books, University Alumni Lists, Who's Who in Engineering, Who's Who in Chemistry, Who's Who in America, the State Manual, a good U. S. Atlas, a good World Atlas, dictionaries (English, French and German; also Italian, Spanish and Dutch), Sweet's catalog, Chemical Catalog, Annual Reference and Data Number of WATER WORKS AND SEWERAGE, an up-to-date handbook on each specialty, a good commercial directory, a good periodical index such as "Industrial Arts," "Municipal Index," etc. In addition to Industrial Arts Index, several other agencies are available for tracing down periodical literature, as Chemical Abstracts, Engineering Abstracts, and the cumulative indexes of the American Water Works Association, New England Water Works Association, American Society of Civil Engineers, etc.

## Miscellaneous Suggestions

A few miscellaneous suggestions, resulting from experience, might include the use of vacuum cleaning for freeing the open shelves from dust. In most modern buildings a vacuum system is installed and a man may be engaged very reasonably to shake up and vacuum off the material, particularly on the lower shelves.

Sheets of paper 8½ by 11 inches, gummed on the back, are very useful in many ways as they can be run into the typewriter and then cut down to any desired size of label.

The use of colored cards has been adopted to denote difference in location, all the books in the stacks of the chemical laboratory, for instance, being cataloged on orange cards which are thrown into the general catalog alphabetically. In the catalog file the subject and trade name cards are blue.

Out-of-size textbooks formerly were segregated in a separate group, their cards being marked with a double star. This was found unwise, because in running through a classification a staff member would forget this material. At present these out-of-size books are piled flat at the end of the classification, and the cards are marked "filed flat."

The matter of expansion is always difficult in a small library on account of the limited amount of spare shelving which it is economically practicable to make available. To this end it has been made a practice every five years to go over the material in the library and eliminate "dead wood." In adding to certain of the files, old issues are automatically discarded, only a five year set being retained. This need for conserving space sometimes necessitates the shifting of sets of periodicals, and such. To aid in finding such material as has changed its location a sketch of the library stacks with a list of the outstanding classes of material, (on which the stacks are numbered consecutively and the material numbered correspondingly) has been framed and hung above the librarian's desk. The back of the frame is removable so that changes can be made in the listings.

One function of the special library which has not been touched upon is that it should be informed of the facilities of other neighboring libraries and of material which may be borrowed. To this end membership in the local branch of Special Libraries Association is helpful. It not only affords an opportunity to discover what is in other libraries but establishes pleasant relations with other librarians, which aids in maintaining a spirit of coöperation with respect to loans.

▼

## Newark's Leakage Survey Proves A W.P.A. Project with Merit

In Newark, N. J., a W.P.A. Leakage Survey Project employs 20 men (in 5 field crews) working mostly at night with radio type sensitive leak detection instruments. The survey extends to service lines and so far 328 leaking services (34,231 tested); 60 defective gate valves (4,294 tested) and 90 leaking hydrants (2,195 tested) have been located. In the survey, uncharted service connections and curb-boxes are being spotted and mapped on 150 sectional map cards as a permanent record. W.P.A.'s "W.W.Ds." (Water Waste Detectives) working for the Newark Water Department can so far be credited with a saving of a hypothetical $25,000 worth of water through leak stoppage. The work is now about 50 per cent completed, according to reports from W.P.A. and W. G. Bank, Chief Engineer of Newark's Water Department. [Amongst other things, the survey has shown that Mr. Bank has a pretty well maintained system.—ED.]

▼

## Penna. Commissioner Wants Cities to Take Over Water Companies

The following interesting news item has reached us as an Associated Press release to the press—dated July 18, 1938, from Harrisburg, Pa.

"State ownership of streams, lakes and rivers, and municipal ownership of water companies were proposed today as a means of supplying water to future generations. Public Utility Commissioner Richard J. Beamish, said he would ask his colleagues on the commission to request the Legislature for laws enabling municipalities to take over all private water companies."

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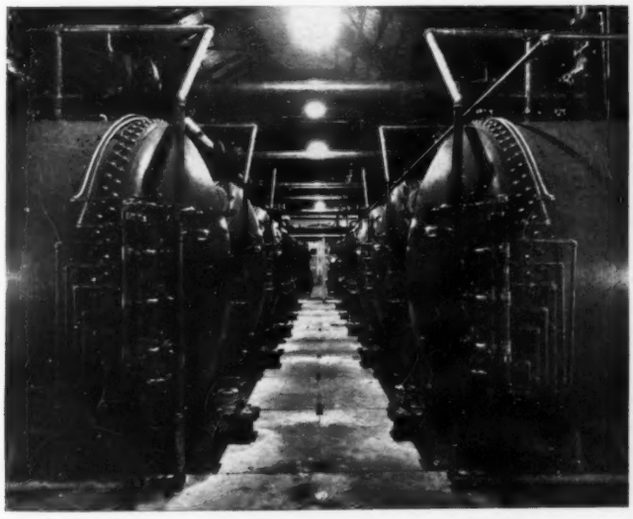

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1. Clean the flange.

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*Fig. 5500*

# "COMMINUTING" Type
# CENTRIFUGAL PRIMARY SLUDGE PUMP

INSTALLATION RECORD:

Sewage Treatment Works.....Geneva, Illinois
Plant Operator.....J. H. Burgeson
Size of Plain Bar Screen.....2-inch clear
Type of Primary Sludge Pump
"AMERICAN" 4x4" Comminuting Centrifugal Primary Sludge Pump
Months of Continuous Operation.....9 months
Number of Times Clogged and Pump had to be opened.....none

Simplicity and accessibility are paramount design features of "AMERICAN" centrifugal primary sludge pumps. Sewage Plant operators report that these pumps are remarkable for their ability to handle primary sluge without clogging.

*BULLETIN NO. 235 will gladly be supplied on request.*

## THE AMERICAN WELL WORKS

**GENERAL OFFICE AND PLANT: AURORA, ILLINOIS**

**Dept. WS-938**

MECHANICAL AERATORS—ROTARY DISTRIBUTORS—SLUDGE COLLECTING MECHANISMS—
SEWAGE PUMPS—DEEP WELL TURBINE PUMPS

The LOCK JOINT "Book of Experience"

Manufacturing Pipe at Little Rock, Ark.

## 800 Feet of Pipe per Day

MANUFACTURING and installing 800 feet of 39" diameter Concrete Pipe per day for Little Rock, Arkansas, to complete the job three months ahead of schedule was made possible by more than three decades of experience in Concrete Pipe construction.

When time is a factor in completing the job, you can always be assured of speed *plus* uniform high quality if Lock Joint Reinforced Concrete Pressure Pipe is used.

We will gladly furnish estimates on your proposed pipe lines. Write us for further details and specifications.

**LOCK JOINT**
***Reinforced Concrete***
**PRESSURE PIPE**

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Pressure : Sewer : Culvert : Subaqueous

# The Editor's Comments

## EVERY WATER WORKS NEEDS A "G-MAN"

NOTHING in a busy day of a water works manager is less satisfying than to have a complaining customer leave the office still with a doubt in his mind that his meter has not been over-read; or, else, that it is obliged to be registering too much water. Little is more important to water utility heads in these times than the good will of the public, born of satisfied customers. On this phase of operation and management more thought is being given today than ever before.

In handling dissatisfied customers, a pleasing personality is worth a whole lot; the value of argument which may sound worthy, sincere and logical can not be discounted. But the most valuable contribution to happy public-relations is an admission that there is at least a possibility that the meter may not be 100 per cent correct; that, it can and will be checked for accuracy. When such is done, the customer usually feels that he has had every attention due him, and the act registers as an appreciated service from the utility.

However, it costs something to remove, check, and reset meters. Furthermore, it is but part answer to the problem—why the large water bills? Today, we hear much concerning a means of circumventing meter removals and tests, the findings from which can almost invariably be predicted in advance. Instead of cross-questioning the customer or members of his household, and presenting time-consuming argument, as convincing as possible as to what are the most likely reasons for the excessive water bill, it is now possible to say—"Mr. Customer, we feel that there is one best way to check into your complaint. It will very likely save you some money, and it will with certainty save a lot of speculation and argument. We will put our 'G-Man' to work on this case." Did you say, "Who, or what, is this 'Water Works G-Man'"? That is answered in the first article in this issue, "Putting the G-Man to Work," the contribution of Roger W. Esty, superintendent of the Water Department of Danvers, Mass.

The "Water Works G-Man," as Mr. Esty has dubbed the device, is a portable compact instrument which, when attached to a water meter in service, records the timed frequency of water operation and the rate of flow through the service line every minute during a 24-hour day. In this manner, the customer's meter is made to tell its own story, while in actual service, for the benefit of all—particularly, the customer. The chart reveals clearly whether the meter is "sleeping" when the customer's family is sleeping, or whether there are leaks somewhere which do not let the meter sleep. Perhaps the "G-Man," on watch 1440 minutes of the day, taking notes in the form of red lines on the instrument chart, will reveal the next day that someone flushed the toilet at 12:31 a. m. What's important about this particular recording is that the person forgot to jiggle the handle on the flush tank before going to bed. Result, the ball-valve remained open part way for six and one-half hours. The wasting water deprived the meter of its rest the balance of the night, and kept the "G-Man" busy putting down "black marks" (only they are red) on the chart against a forgetful flusher.

Now, when Mr. Customer is shown the chart revealing the day's history of water drawings, toilet flushings, how long it took Mazie to wash the dishes, how long it took and how much water was used to sprinkle the lawn or garden—and, what that running flush tank did to the meter register—he really learns "things that every customer should know." With the report of the never-sleeping "Water Works G-Man" on the table, and with a few words of interpretation by the water official, there is no room for argument or need for speculation. Mr. Customer recalls that lately he had had to go back and jiggle the flush tank handle, himself, on two occasions. Also, he may see plainly that the new spray dish washing gadget he bought for Mazie last month took more water than the less sanitary dish pan method which he didn't like. Another customer may have learned that his meter couldn't get any rest at night because of what proved to be a number of hidden small leaks along his service line. He may see that the "G-Man's Notebook" explains to him why the grass grew greener along the service line across the lawn. These are just samples of the things that the "Water Works G-Man" reveals to the mutual satisfaction of Mr. Customer and the water official handling consumer complaints, even if embarrassing to the first.

In the customer's mind there's something uncanny about an instrument that reveals such irrefutable evidence. Any distinction between the recording device and the meter proper is lost sight of. Faith in the meter being restored, and respect for a management employing such methods being established to a high degree (plus a bit of customer embarrassment), results in payment of the bill on the spot—frequently a word of commendation and appreciation being added. And, as Mr. Esty points out, it is the next water bill that clinches the matter of improved relations. It brings the "Thank you" (with a smile) when customer and manager next week.

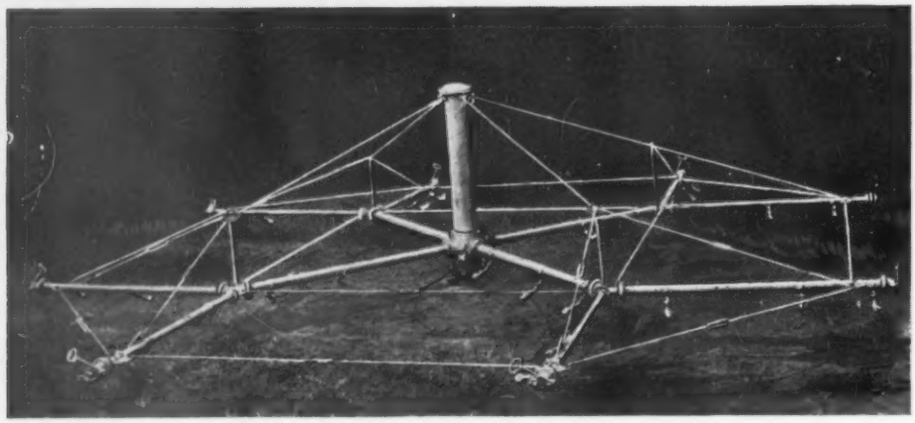
As recorded in previous issues of this magazine, testimony as to the value of such 24-hour recording instruments, placed on complaining customer's meters, is also being heard from other managers attending meetings of water works associations. Only last month, before the Virginia Section of A. W. W. A., D. R. Taylor, superintendent of the Water Department of Roanoke, Va., recited his experiences with recording instruments placed on consumer's meters. The resulting record chart had proved the most effective means yet discovered for amicably and promptly settling high-bill complaints and refuting claims of plumbers, employed by the customer, that all leaks had been repaired. In contrast, methods and experiences of some other managers sounded archaic. What it would take Esty's or Taylor's "G-Men" one setting to discover, took several inspections and pokings-about to uncover. And, even then, it was a matter of some luck that peculiar hidden causes of consumer water waste and high bills were detected.

In addition to its constant value in settling customer complaints satisfactorily and economically, Mr. Esty cites and describes other uses and applications of the "Water Works G-Man." Amongst these is the selection of the proper meter for 24-hour duty on important services, resulting in more accurate recordings and revenue increases such as quickly pay for the instrument. Another use is that of checking the tightness of mains through records made on by-pass meters during night flows.

# THE AERO-FILTER

HALVORSON-SMITH PROCESS
(Patents Pending)

**An Improved Trickling Filter**



A Multiple-arm Distributor designed for use with a 34' diameter Aero-filter.
WEST UNIVERSITY PLACE, TEXAS

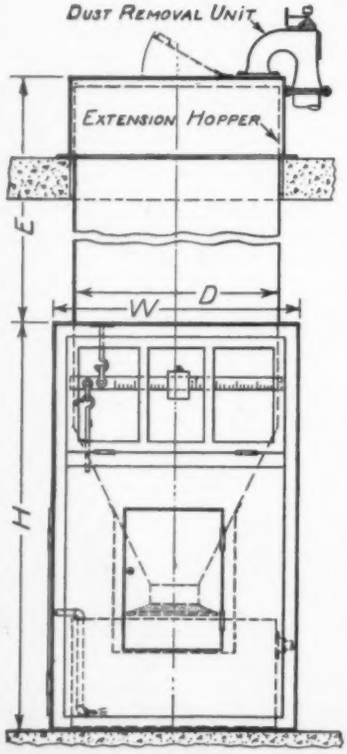
The Aero-filter is a Low-rate, High-Capacity trickling filter now operating in eight states. It insures excellent B. O. D. reductions at lowest initial and lowest operating costs of any complete treatment.

Write us for information about our multiple-arm, reaction-type rotary and motor-driven disc distributors, specially designed to give the uniform, low-rate dosage necessary for the efficient operation of a high-capacity filter.

## Lakeside Engineering Corporation

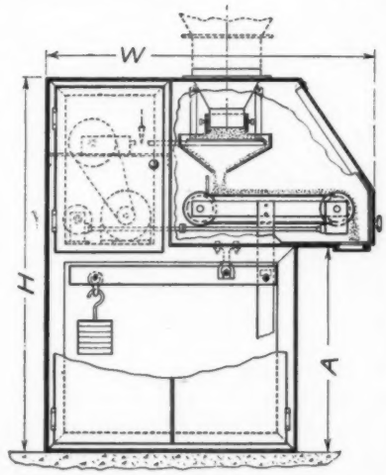
222 W. Adams — Chicago

# OMEGA AT DENVER




LEFT: At the Moffat Tunnel Filtration Plant, five Omega Batch Gravimetric Feeders for feeding lime, alum, carbon and ammonium sulphate are installed, also one Omega Lime Slaker. Alvord, Burdick & Howson of Chicago, Consulting Engineers.

RIGHT: At the new Sewage Treatment Plant, four Omega Belt Gravimetric Feeders for feeding lime and ferrous sulphate are installed, also two Omega Lime Slakers. Black and Veatch of Kansas City, Consulting Engineers.




**THE NEW OMEGA CATALOG**

Gives full information about the following equipment:

**OMEGA GRAVIMETRIC FEEDER—BATCH TYPE** Illustrated at left. A weight controlled feeder with batch hopper. Accuracy within 1%.
**OMEGA GRAVIMETRIC FEEDER—BELT TYPE.** Illustrated at right. A weight controlled feeder supplied from an overhead bin or hopper. Accuracy within 2%.
**OMEGA LIME SLAKER.** For continuously slaking quicklime. Usually furnished in combination with Omega Gravimetric Feeders of the Batch or Belt type.
**OMEGA UNIVERSAL FEEDER.** A volumetric feeder for dry materials, made in three sizes, to suit a wide variety of conditions.
**OMEGA WEIGHCHECK FEEDER.** A volumetric feeder for dry materials, mounted on built-in hopper scales. Capacities up to 2,000 lbs.
**OMEGA DISK FEEDER.** A volumetric feeder for dry materials, especially for plants where the hopper is to be filled from the floor on which the feeder is located.
**OMEGA PRECISION FEEDER.** A decanting type of feeder for liquids. Built in several sizes, accuracy within 1%.
**OMEGA PRESSURE FEEDER.** A modification of the Precision Feeder with a built-in motor-driven pump for feeding liquids under pressure.
**OMEGA LABORATORY STIRRERS.** For jar tests for coagulation and other laboratory tests. Made in 4 sizes.

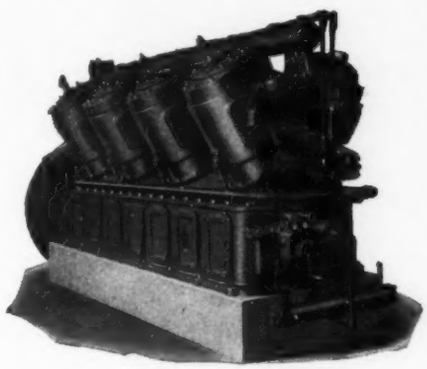
**OMEGA MACHINE COMPANY, 4010 Penn, Kansas City, Mo.**

# EQUIPMENT NEWS

## New Gas Engine

The new type PVG gas engine was shown by Ingersoll-Rand for the first time at the 1938 International Petroleum Exposition. It is designed for use wherever gas is available as a fuel.

The PVG is a 4 cycle, V-type, multi-cylinder engine, built especially for full load continuous duty, such as is demanded of gas engines driving generators, blowers or pumps at sewage treatment works.



*New Ingersoll-Rand Engine*

Furthermore, it operates at the moderate speed of 400 r.p.m. The PVG is available in three sizes (4 cyl.-185 hp.) (6 cyl.-275 hp.) (8 cyl.-370 hp.) and has the same cylinder arrangement and cylinders as Ingersoll-Rand's earlier XVG engine, which has been in successful use since 1932. In fact, both engines are produced in the same plant.

For illustrated bulletin No. 10,011—write Ingelsoll-Rand Company, 11 Broadway, New York, N. Y.

▼

## Syntron Offers Continuous Weigh Feeder

Syntron Company, manufacturers of the well known Syntron Vibratory Feeder for dry chemicals, announces an improved heavy duty model—an Automatic Continuous Weigh Feeder.

The machine consists of the Syntron Vibratory Feeder which causes a steady flow of dry chemicals onto a constant speed belt conveyor, which is suspended from a weighing scale equipped with sensitive electric valves. These control valves function to maintain the discharge of chemical, *by weight*, at the rate set by the operator. Slight underweight on the belt (lagging dosage) causes a speeding up of the vibratory element and increased rate of feed. The reverse takes effect should a creeping up of rate (over-feed) disturb the scale balance.

For more detailed information on these heavy duty Syntron Vibratory Feeders, ranging in capacities from 25 lbs. to 25 tons per hour, address, Syntron Company, 650 Lexington Ave., Homer City, Pa.

## Electro Rust-Proofing

(Tank Preservation by Cathodic Protection)

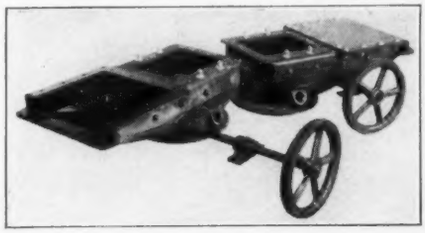
Electro Rust Proofing Company of Dayton, Ohio, are offering a system and equipment for preservation of tanks and standpipes against interior corrosion. The scheme is an adaptation of "cathodic protection," the basic principles of which are described in an article by Starr Thayer in our August issue. The process has proved highly successful in the protection of pipe lines against soil corrosion.

In the brochure describing the Electro Rust Proofing Company's system, the scheme and equipment required is described. The process involves holding the protective hydrogen film on the metal surface. Such is accomplished by electrical voltage which forces a minor current flow into the tank walls from an electrode of stainless steel, suspended vertically at tank center. Thus the tank wall is negatively charged, and the positively charged hydrogen film adheres. A guarantee by the proprietors is that pitting of tank walls will not exceed 1/10,000th inch per year, the cost being less than usual tank maintenance cost. The claims are that two years of average maintenance cost pays for the installation; that the consumption of current rarely exceeds that of a 50 to 100 watt lamp; that further need for cleaning or repainting interior tank walls is eliminated. The scheme is illustrated in the brochure. For a copy, write Electro Rust Proofing Company, Tulsa Lane, Dayton, Ohio.

▼

## Dust-Tight Slide Gates for Treatment Plants

Pictured above are two "Rex" Dust-Tight Slide Gates produced by Chain Belt Company of Milwaukee, for storage bins holding lime, sulphate of ammonia, activated carbon, alum, etc., at water and sewage treatment plants.



The full opening of these gates is 12x12 inches. They have dust-sealed lubricated ball-bearing rollers, slide plates of self-sealing design, and air vented cast-iron body. The first fourteen of these "Rex" Dust-Tight Gates have gone into the new Milwaukee Filter Plant. For more detailed description, write Chain Belt Co. (Sanitation Div.), Milwaukee, Wis.

**When You Specify**

***Meters and Recorders***

**Be Sure To Demand**

**• ACCURACY • RELIABILITY**
**• SOUND ENGINEERING**
**• MODERN APPEARANCE**

**Regardless of whether your problem calls for the use of a Venturi Tube, Weir, or Flume, you can depend on Bailey Meter Company to design and construct both the primary element and the register for maximum accuracy.**

**A vast amount of experience gained from thousands of installations of metering equipment, together with extensive experimental work in our own hydraulic laboratory and in the laboratories of the Ohio State University, Cornell University, Case School of Applied Science and other institutions, is back of every Bailey Primary Element.**

**The reliability of Bailey Meters and Recorders is attested to by the fact that thousands of dollars worth of steam and water are sold monthly and billed solely on the basis of readings from Bailey Meters.**

**No small share of the accuracy and reliability of Bailey Meters is due to the conservative engineering policy of the Company. New ideas and designs are not offered for sale until they have been thoroughly tested both in the laboratory and in actual service.**

**Bailey Meters, Recorders and Controllers present a thoroughly modern yet conservative appearance.**

**Write for your copy of Bulletins No. 301 and 302, describing Bailey Fluid Meters for steam, liquids, gases, sewage, sludge, and compressed air.** MU-16

**BAILEY METER • COMPANY •**

**1072 Ivanhoe Road, Cleveland, Ohio**

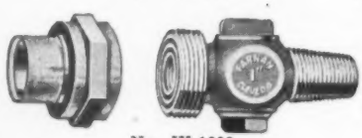
BAILEY METER COMPANY LTD., MONTREAL

FOR DEPENDABLE QUALITY SPECIFY

**"FARNAN"**

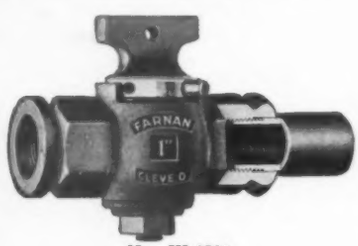
**Our complete line consists of Corporation Stops, Curb Stops, Couplings and Fittings for copper, iron and lead pipe services . . . all thoroughly tested with 200 lbs. hydrostatic pressure.**

No. W-100



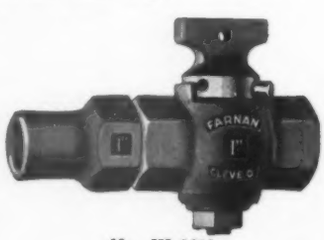
No. W-1000

**We have had 86 years of manufacturing experience.**



No. W-3780

**For complete information write for your copy of our new 96-page, fully illustrated catalog.**



No. W-3600

**THE FARNAN BRASS WORKS CO.**

*Established 1852*

CLEVELAND OHIO

## Metallizing Simplified

In the water works and sewerage field "Metallizing" is a process which bids fair to become increasingly important and useful. Especially so in repairing and restoring worn metal parts such as shafting, valve or pump rods, and all kinds of bearing surfaces; also for repairing defects in castings, mending split or cracked parts. Possibly more important will "Metallizing" become in laying on protective coatings of corrosion resistant metals.

The process consists of automatically feeding a wire of a pure metal or an alloy through the "Metallizing Gun." In the gun a small oxy-hydrogen jet melts it at the nozzle. Compressed air admitted to the nozzle converts the molten metal to a mist and atomizes it onto the surface to be coated or built up. The Metco Gun, now being offered by Metallizing Engineering Co., of New York City, is so compact that it may be used as a hand tool for application of a coating to large surfaces, tank walls, etc., such as a zinc, aluminum or lead protective coating. It may be used as a lathe tool for precision application of metals in building up worn shafts and rods, with steel, monel metal, bronze, stainless steel, and other metals.

*Metco Gun—Type E*

The new Type E Metco Gun represents the most improved type of "Metallizing" gun, and is the result of considerable experience with the process. It is faster, more reliable and is economical in respect to waste of metal wire and also in gas consumption. The new gun weighs only 3¼ lbs., and has balance and a hand grip designed to minimize operator fatigue. The multiple jet turbine makes instantly available two speed ranges at 60 lbs. air pressure. In the brochure describing the Metco Gun and its adaptations, supported by many illustrations, additional important details are presented. From what seems possible with such equipment, "Metallizing" should prove a valuable process in water works and sewerage maintenance and of importance to managers and engineers interested in operating economies. For Bulletin P. 10 "Metallizing" and Bulletin 37 "The Metco Gun," write Metallizing Engineering Co., 44 Whitehall St., New York, N. Y.

## Flow Indicator and Control Switch

The Howe Flow Switch is designed for attaching to pipe lines for the purpose of (1) indicating start, continuity, or cessation of flow; (2) pump, compressor or valve control in flow and pressure control.

This switch represents a new development in flow and float switches. Its simplicity is emphasized, there being no mechanical movements between impeller or float and the contact making chamber. Having permanent magnets on each side of a solid partition, the switch is operated through electro-dynamic torque. It has no packing joints, springs or syphons to give possible troubles or necessitate maintenance.

*Howe Flow Switch*

This simple switch may be installed in horizontal or vertical position to make a record, or sound an alarm, when flow ceases or starts, or when pressure mounts above or drops below desired limits. It may be employed to control any type of electrically operated pump, compressor or valve, to control flow or pressure and water levels. It operates under any pressure and at temperatures up to 700 deg. F.; has the approval of Factory Mutual and the Underwriters Laboratories. For detailed description, write Howe Electric Co., 53 W. Jackson Blvd., Chicago, Ill.

▼

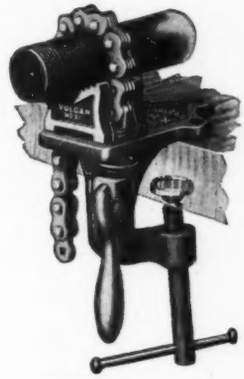
## Duff-Norton Pull-Push Pipe Jacks

A new pipe pulling and pushing jack has just been announced by Duff-Norton Co. of Pittsburgh. It has been built sufficiently sturdy and powerful to push or pull through the ground pipes up to 6 inches diameter. It is a geared jack, designed for either push or pull operations without change of the jack setting.

In a recent folder from Duff-Norton Co. are illustrated the unique applications of the new pipe jack. Also, other Duff-Norton appliances such as trench braces, timber braces, heavy jacks for general utility. For copy of Folder No. 120 write Duff-Norton Mfg. Co., 2709 Preble Ave., Pittsburgh, Pa.

### "Vulcan" Pipe Vise

The "Vulcan" Clamp Vise No. 21 is a new product of J. H. Williams & Company, New York, N. Y. It is firmly attached to bench, post, truck, etc., without use of bolts or screens; weighs but 5¾ lbs. and accommodates pipe from ⅛ to 2 inches in diameter.



*New Vulcan Vise*

Unusual efficiency is claimed for the clamping device in which are incorporated novel features. Such, for instance, is the forward angle of the clamp screw, which carries a swivel with thin V-lip projecting from its upper edge. In consequence, security and rigidity in attaching is assured. The drop-forged jaws are saw-tempered for file sharpening and the chains are of the same quality as those in the well known "Vulcan" Chain Tongs. For further information write J. H. Williams & Co., 75 Spring St., New York, N. Y.

▼

### Coleman Power Sewer Cleaner

Allan J. Coleman, manufacturer of sewer cleaning equipment, announces the new Coleman Electric Power Driven Cleaning Machine, designed by a firm of long experience in sewer cleaning and maintenance.

The motor driven drums are large and powerful enough to handle 250 ft. of ¾-in. wire cable. By a patented hand controlled gear feed the speed of cable feed is readily adjusted to meet conditions as encountered (slow boring, or fast work). While boring through obstructions the cable whip removes accumulations from the side walls. Reversing the drum pulls the cable and tool out and recoils the cable without need for touching it with the hands.

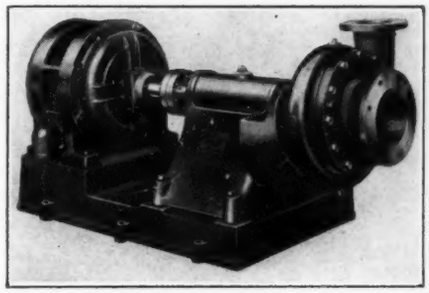
The machine is completely enclosed in a neat steel box (22x34x36 inches) with wheels on one end. It can be wheeled through any ordinary doorway; weighs 400 lbs. with 110 ft. of cable; can be handled and operated by one man.

For details and illustrations ask for the new Coleman Power Cleaner bulletin; address Allan J. Coleman, 120 W. Illinois St., Chicago.

### Lawrence "Vortex" Pump

Lawrence Pump and Engine Co. of Lawrence, Mass., announce the new type "HBD" side suction "Vortex" pump in sizes from 1½ to 18 inch discharge; capacities 10 to 15,000 g.p.m., against heads up to 300 ft. in the smaller sizes.

The casing is of solid volute design, with eccentric nozzle on suction head to permit removal of the head without disturbing discharge pipe or pump alignment. Air pockets are likewise eliminated. Impellers are of enclosed type, supplied in cast-iron, bronze, or special alloys. To insure perfect alignment the supporting bracket and pump casing are separate parts, with machined male-female fit between. The two heavy duty double-row ball bearings, entirely external from the pump, support the shaft and are oil reservoir lubricated. The near bearing carries radial load only and is self aligning. The outer bearing, of angular contact type, carries thrust and radial loads. The packing gland is the split-bronze two piece interlocking type that may be completely removed with ease when packing the stuffing box.



*Type HBD Lawrence Pump*

Bulletin D-48 presents a complete illustrated description of the new "HBD" "Vortex" pump. Address Lawrence Pump and Engine Co., P.O. Box 70, Lawrence, Mass.

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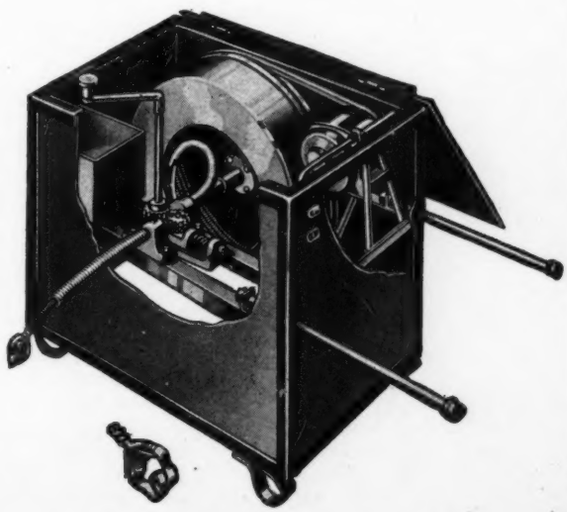
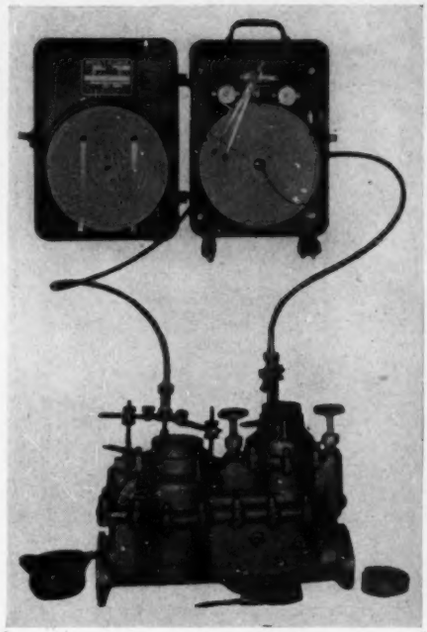


*The Coleman Sewer Cleaning Machine*

*The*

# METER-MASTER

is the *Only* Recorder giving a continuous record. Maximum and Minimum flows recorded for 6 and 24 hour periods, or 24 and 72 hour periods on round charts and Strip Chart Records may be obtained with chart speeds of 1, 3 or 6 inches per hour or 1, 3 or 6 inches per minute.

•

# SERVES

on any water meter, single or Compound. Record of the meter is not interrupted. No batteries.

•

# SAVES

*"saves its cost in less than one month,"* report many users. Saves loss through oversized meters. Serves in settling disputed bills.

•

# SATISFIES

customers' complaints of high bills by showing time, rate and amount of use. Hence improved public relations is a further valuable by-product of Meter-Master use.

***For Full Information Address***

**F. S. Brainard & Co.**

246 PALM ST.
HARTFORD, CONN.

COPPERAS
(FERROUS SULPHATE)
· · · · FOR WATER & SEWAGE TREATMENT
(The Base For Chlorinated Copperas)

SEWERAGE TREATMENT

For Sewerage Treatment, we wish to call your attention to a well-known authority* and his published reasons* for selecting Chlorinated-Copperas, as a coagulant.

1—Chlorinated-Copperas proved to be the cheapest coagulant to produce desired results under existing conditions.

2—Chlorinated-Copperas is desirable as a coagulant because of ease of handling, low cost, and ease of application.

(*Name available upon request.)

WE INVITE YOUR INQUIRIES

FAESY & BESTHOFF, INC.
22 E. 40th St. New York

### The New Everson Automatic Vacuum-Controlled Chlorine Sterilizer

The Everson Manufacturing Co., 214 W. Huron St., Chicago, Ill., is announcing a new automatic vacuum-controlled chlorine sterilizer for the water works and sewerage fields. Its development comes as the result of extensive research and experimental work carried on over a period of several years.

The manufacturers report that this instrument for the measurement and feeding of chlorine gas as a solution has been designed to provide automatic, safe and accurate operation, not only under all usual circumstances, but under the unusual as well.

Briefly it is described as a Rota-meter (or Rota-relay for large capacities) automatic gas shut-off vacuum sterilizer embodying the following features: exceedingly accurate, visible control of gas flow; great capacity range—ratios from 1½ to 65; only 2 moving parts; single valve control located directly below visible meter; upward flow of water through absorption tower; automatic gas shut-off, should water pressure fail through pump stoppage, line leak or other cause; electrically operated water shut-off, synchronizing "on-and-off" of sterilizer with that of pump; complete vacuum feed; separation of water and gas lines; water-sealed gas vent with syphon break that prevents back flooding; ability to operate with low water pressure; easy accessibility of all parts; non-corrodibility, those parts which contact chlorine, either as a gas or in solution being of rubber, glass, silver or tantalum; standard (SAE) threads and parts for easy servicing.

The sterilizer is entirely self-contained, with only the visible Rota-meter, single valve control, and connecting lines outside the container walls. It is provided in modernistic enameled steel cabinets, in tower (set back), or in panel designs.

▼

### Hydraulic Footlift Truck

What is belived to be the acme in lift trucks for handling heavy loads, such as one ton chlorine containers (3,300 lbs. filled) and other chemicals at water and sewage treatment plants, has just been announced by the Lewis-Shepard Company of Watertown, Mass., and Crawfordsville, Ind.

This company is well known for its various jack-type low gravity lift trucks. Now, in addition to lever jacking with the truck handle, this company offers the Hydraulic Footlift in various capacities up to 8,000 lbs. The lifting operation is performed by means of a foot-pedal which is always ready to lift. The release control gives variable lowering speeds and shockless completion of the lowering.

## WITH THE MANUFACTURERS

### Worthington Changes in Gas Engine Sales Personnel

W. E. Wechter, in charge at New York of engine sales for Worthington Pump and Machinery Corp., in the Atlantic Division, has been transferred to Buffalo as Manager of the Oil and Gas Engine Application Division. He will be assisted by J. F. Hecking, who continues in his present capacity of assistant manager of this Division.

In the Atlantic Division, oil engine sales will be covered by H. C. Wood at New York, while W. L. Russell, at Harrison, N. J., will take over the gas engine sales.

J. C. Barnaby, former manager of the Engine Application Division and responsible for engines sales in the Central Division, takes charge of special engineering work covering engine research and design, and will devote his entire time to this activity.

▼

### U. S. Pipe Research to Be Directed by Dr. Schuh

The United States Pipe and Foundry Company announces the appointment of Dr. Arthur E. Schuh as Director of Research.

Dr. Schuh received his B.S and Ph.D. Degrees from the University of Chicago, specializing in physical chemistry. Since 1929 he has been associated with the Bell Telephone Laboratories, where, as physical chemist, he has been responsible for investigations in several fields, such as the protection of metals against corrosion by metallic and organic finishes. Previously, Dr. Schuh was connected with the Western Electric Company in Chicago, where he was occupied with metal-protective processes.

Dr. Schuh is the author of many technical papers on organic coatings, finishes and protective coatings for metals.

### Guide Chart for Taste and Odor Measurements

The manufacturers of "NUCHAR" Activated Carbon, who pioneered in the application of powdered activated carbon in taste and odor control, have from time to time in the past distributed "gadgets" of value in water treatment practice, as aids to chemists and plant superintendents.

The newest contribution has recently been received. It is essentially a "charted course" through the favored procedure of evaluating odors in waters by the "Threshold Test." It might be called "A Primer for Taste and Odor Determinations." Of substantial cardboard, it is a 10x16 inch wall chart. Its directions take the user, step by step, through the procedure of making the Threshold Odor Test, employed in controlling the important "Threshold Number" of the water, before John Q. Public finds another number—namely, the telephone number of the water works.

This guide has been especially designed to chart the course of the operator (familiar with, or otherwise) through the test. Each step is presented in non-complicated style. Of marked aid to the novice are the illustrations of laboratory equipment involved and its use, incidentally proving the truth of a Chinese adage that "one picture is worth more than a thousand words."

In addition to the test procedure, a method and equipment required in producing odor free water is illustrated. Tables of useful conversion factors and a helpful chart for conversion of dilution ratios to Threshold Odor Numbers adds value to NUCHAR'S "T. & O. Primer." One of these worth-having wall charts will come to the reader merely for the asking. Address Industrial Chemical Sales Div., W. Va. Pulp and Paper Co., 230 Park Ave., New York, N. Y.

▼

### Crane's Sound Picture "Flow"

In a new sound picture entitled "Flow," just released by Crane Co., appear scenes of rivers in flood, thundering waterfalls and, then, primitive means of controlling flow. Then follows an educational tour through the Chicago works of Crane Co., where the various steps in valve manufacturing are revealed. It shows valves varying in size from towering giants to the smallest.

An absorbing scene shows one of the largest drop hammers in the country striking a block of white hot steel with the force of 8,300,000 foot pounds, shaping a big valve flange in the process. And the pouring of metal in the foundries offers another striking picture. Constant testing and research activities reveal that science serves to insure the maintenance of high quality standards. It is understood that arrangements can be made with Crane Co. to have this interesting and entertaining picture shown to a limited extent at sectional meetings of water works and sewerage associations. If interested, write the Publicity Department, Crane Co., 836 S. Michigan Ave., Chicago.

# MEETINGS SCHEDULED:

Sept. 13-15—College Park, Md. (University of Maryland).
**Short Course for Operators of Water & Sewage Treatment Plants.** Chairman, Short Course Committee, Carl A. Hechmer, Hyattsville, Md.

Sept. 14-16—Saginaw, Mich. (Bancroft Hotel).
**Michigan Section, A. W. W. A.** Sec'y, M. N. Gerardy, Water Board Bldg., Detroit, Mich.
(Meeting Jointly with)

Sept. 14-16—**Michigan Conference Water Purification.** (Annual Convention). Sec'y-Treas., R. J. Faust, Michigan Dept. Health, Lansing, Mich.

Sept. 19-20—Watertown, S. Dak.
**South Dakota Water & Sewage Works Conference.** Sec'y W. W. Towne, Board of Health, Pierre, S. Dak.

Sept. 22-23—Poughkeepsie, N. Y. (Nelson House).
**New York Section, A. W. W. A.** Sec'y, R. K. Blanchard, 50 West 50th street, New York City.

Sept. 26-27—Minot, N. Dak. (Hotel Leeland Parker).
**North Dakota Water & Sewage Works Conference.** Sec'y-Treas., M. D. Hollis, Bureau of Sanitary Engineering, Bismarck, N. Dak.

Sept. 27-28—Columbus, Ohio (Fort Hayes Hotel).
**Ohio Conference on Water Purification.** Sec'y, Thos. R. Lathrop, State Dept. of Health, Columbus, Ohio.

Sept. 29-30—Columbus, Ohio (Fort Hayes Hotel).
**Ohio Conference Sewage Treatment.** Sec'y, B. M. McDill, Dept. of Health, Columbus, Ohio.

Sept. 29-Oct. 1—Minneapolis, Minn. (Hotel Nicollet).
**Minnesota Section, A. W. W. A.** Sec'y, R. M. Finch, 416 Flour Exchange, Minneapolis, Minn.

Oct. 2-5—New York City, N. Y. (Hotel Pennsylvania).
**American Public Works Association** (Congress). Executive-Director, Frank W. Herring, 1313 East 60th street, Chicago, Ill.

Oct. 6-7—Washington, D. C. (Hotel Raleigh).
**Four States Section, A. W. W. A.** Sec'y, Carl A. Hechmer, Dept. Engr., Washington Suburban San. Distr., Hyattsville, Md.

Oct. 6-8—Hartford, Conn. (Bond Hotel).
**New York State Sewage Works Association.** Sec'y, A. S. Bedell, State Board of Health, Albany, N. Y.
(Meeting jointly with)

Oct. 6-8—**New England Sewage Works Association.** Sec'y, F. W. Gilcreas, State Dept. of Health, Albany, N. Y.

Oct. 10-12—Milwaukee, Wisc. (Hotel Plankinton).
**Wisconsin Section, A. W. W. A.** Sec'y, Al A. Smith, City Hall, Madison, Wisc.

Oct. 12-14—Rochester, N. Y.
**American Society Civil Engineers.** Sec'y, Geo. T. Seabury, 33 West 39th St., New York City.

Oct. 13-14—Neenah-Menasha, Wisc.
**Central States Sewage Works Association.** Sec'y-Treas., W. H. Wisely, State Dept. of Health, Springfield, Ill.

Oct. 13-15—Morgantown, W. Va.
**West Virginia Conference on Water Purification.** Sec'y, J. B. Harrington, Division of Sanitary Engineering, Charleston, W. Va.
**W. Va. Section, A. W. W. A.** (The Organization Meeting of this new Section of A. W. W. A. will be held, and officers elected, during the meeting of the W. Va. Conference.) A. R. Todd, Wheeling, W. Va., Chairman of the Organization Committee.

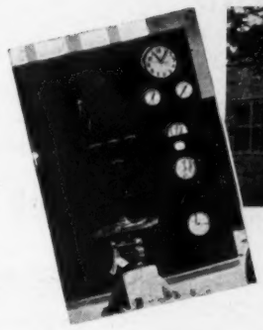
Oct. 13-15—Des Moines, Iowa (Hotel Fort Des Moines).
**Missouri Valley Section, A. W. W. A.** Sec'y, Earl L. Waterman, University of Iowa, Iowa City, Iowa.

Oct. 17-20—Oklahoma City, Okla. (Hotel Biltmore).
**Southwest Section, A. W. W. A.** Sec'y, L. A. Quigley, Supt. City Water Works, Fort Worth, Texas.

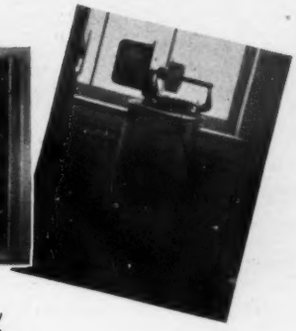
Oct. 19-21—Atlantic City, N. J. (Hotel Haddon Hall).
**Pennsylvania Water Works Assn.** Sec'y, Dr. F. Herbert Snow, 327 Telegraph Bldg., Harrisburg, Pa.

Oct. 20-21—Toronto, Ont.
**Canadian Institute of Sewage and Sanitation.** Sec'y-Treas., A. E. Berry, Ontario Dept. of Health, Toronto.


FLOW AND LEVEL METERS FOR THE COMMUNITY PLANT



**WESTCHESTER, N. Y.**
Panel mounted Type M. Venturi Register—Indicator—Recorder at Rye Lake Pumping Station.



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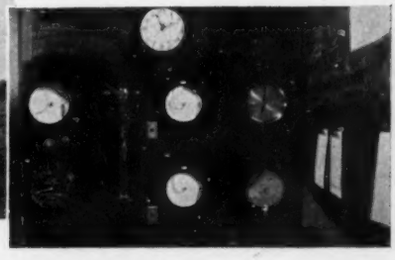
Chronoflo Meter measures flow of raw sewage over weir and controls Wallace & Tiernan dry chemical feeder in proportion to flow; "saving about 200 lbs. of alum per day."



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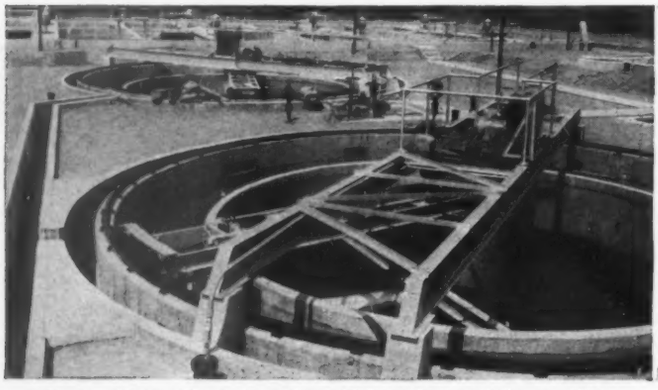
3—16'x225' Automatic Magnetite Filters treat effluent from pre-activated trickling filters.
This installation replaces 3—75' square final humus tanks. The Magnetite Filters are built into the structure of these tanks.



Greece, N. Y., Plant, *Capacity 1 M.G.D.* Howard Thomas, Consulting Engineer.
2 Automatic Magnetite Filters each 4' wide on 35' diameter tanks clarify activated sludge effluent.

**Our newly revised bulletin, now available, gives complete information concerning the design and use of Automatic Magnetite Filters in Sewage Plants.**

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Oct. 21-22—Asbury Park, N. J. (Berkeley-Carteret Hotel).
**New Jersey Section, A. W. W. A.** Sec'y-Treas., H. N. Lendall, College of Eng., Rutgers University, New Brunswick, N. J.

Oct. 25-28—Kansas City, Mo.
**American Public Health Association.** Executive Secretary, Reginald M. Atwater, M. D., 50 West 50th street, New York City.

**Conference of State Sanitary Engineers.** Sec'y-Treas., R. E. Tarbett, U. S. P. H. Service, Washington, D. C. (Meeting jointly with A. P. H. A.)

Oct. 26-29—Riverside, Calif. (Mission Inn).
**California Section, A. W. W. A.** Sec'y, Carl M. Hoskinson, Div. of Water, Sacramento, Calif.

Oct. 31-Nov. 2—Greensboro, N. C. (King Cotton Hotel).
**North Carolina Section, A. W. W. A.** Sec'y-Treas., A. R. Hollett, Chapel Hill, N. C.

# CATALOGS AND LITERATURE RECEIVED

[*Any of the publications reviewed in this section can be secured from or through Water Works and Sewerage, if such be desirable.*]

**"The Automatic Magnetite Filter"**—Is presented in an attractive bulletin just received from Filtration Equipment Corporation of New York. Predominantly employed in sewerage treatment, to date, these ingenious and proven units are being offered for the removal of suspended solids from sewages, industrial wastes, or water. The automatic self-cleansing feature of these filters constitutes an important factor in the economy of filtration, as does the low head required, and friction loss. Both the up-flow and down-flow types are described and illustrated. Their distinctive applications are discussed, and typical results are presented. Magnetite Filters truly constitute an important "new tool in sewage treatment" to insure results of a uniform nature, degree of treatment as required, and cost reduction in plant operation. Such important installations as those at Denver, Minneapolis, Atlanta, Cleveland, and at 10 smaller plants, are pictured. Typical costs (installation and operation) are cited. Amongst the notable features listed are (1) low installation and operating cost as compared to any other method or equipment yielding similar results; (2) loss of head varies from ½ to 6 inches, depending upon size of magnetite sand, bed depth, speed of traveling cleansing carriage, and rate of filtration; (3) makes permissive reduced sizes of settling units, less costly re-treatment ahead of filtration, and insures more pleasing and uniform effluent quality. For a copy of "Magnetite Filters," write Filtration Equipment Corp., 10 East 40th St., New York, N. Y.

**"Swing Diffusers"**—Are the subject of a characteristically attractive (also easy to read) bulletin from Chicago Pump Company. "Swing Diffusers" are the new type of air diffusion units which can be lifted (swung) out of the aeration tank for inspection or service, without dewatering the tanks or even shutting off the air. The diffuser unit is composed of an assembly of streamlined diffuser tubes staggered on opposite sides of a manifold, and suspended from a swing joint at the head of the drop pipe. The assembly (unit at a time, or all together) can be raised to the tank walks by a small portable electric motor drive. "Swing Diffusers" are claimed by the manufacturer, and patentee, to reduce power consumption by advancing more efficient use and distribution of air through adaptation of "Ta-

pered Aeration." Of especial interest are such attributes to cities smaller than 10,000 population where sewage flow and strength shows marked variations, requiring air variation to effect operating economies without depreciation of plant performance. Typical designs of aeration units with "Swing Diffusers" are illustrated and a discussion of the why-and-how of "Tapered Aeration" is presented. For Bulletin 175 write Chicago Pump Company, 2300 Wolfram St., Chicago, Ill.

**"What Cost Water Leaks?"** is the theme of a new bulletin from Globe Phone Mfg. Corp., which pioneered in the development of electrionic water works equipment. In this bulletin is presented the Globe Geophone, a sensitive but non-electrical leak locator, with sound amplifiers and ear-phones; the Globe Pipe Finder which employs radio frequency but is compact, light in weight, simple to use; the Globe Dipping Needle, of extra sensitivity, which water works men consider almost indispensable; and, last, the simple inexpensive Aqua Pipe-Phone so much used by meter readers and inspection men to detect leaks. Hardly a water works meeting passes without reference to the use, and importance, of such instruments as were pioneered by Globe and now presented in 1938 models in the new folder. A list of prominent users appears. Prices quoted are moderate in comparison with the true value of such money saving equipment. For a copy of the new Globe bulletin write Globe Phone Mfg. Corp., 11 West 42nd Street, New York, N. Y.

**"On Holding High C"**—Or a similar phrase, constituted the catchy caption of a recent folder from Wallace and Tiernan Company which tells of the effectiveness of "chloramination" of water for checking pipe tuberculation and biological growths, thereby holding the friction coefficient of watermains at a "high C" for sustained carrying capacities.

The same caption might have been used on a folder recently received from the Hill, Hubbell Div. of General Paint Corp., for it presents data on another method of holding "C" values of water mains high. It discusses the effectiveness of protecting water pipes against corrosion by employing linings and coatings of Hill, Hubbell's "Biturine Akwaline" Enamel. Presented are two reports from The Pitometer Company of New York City, made on important pipe line installations lined inside, and coated (and wrapped) outside, by the Hill, Hubbell process. In one case a "C" value of 155 was obtained on a pipe line 8,757 ft. long of 6⅝-in. O.D. steel pipe. In another, according to The Pitometer Co., the "C" value on 24,000 ft. of 24-in. O.D. steel pipe was actually found to be 160. Pictured are installations of pipe protected by the Hill, Hubbell process of lining and wrap-coating. For a copy write General Paint Corp., (Hill, Hubbell Div.) Cleveland, Ohio.

**"Graphitization"** is discussed in a brochure being distributed by American Cast Iron Pipe Co., which deals specifically with the "Graphitization of Cast Iron Pipe." In this reproduction of his paper presented before the Kentucky-Tennessee Section of A. W. W. A., James W. Moore, Manager of Research and Engineering Sales of the American Cast Iron Pipe Co., discusses the causes, effects, and the prevention of graphitization of cast-iron in a clear cut and interesting manner. In short, graphitization is an end result of external corrosion in soils productive of an acid attack on metals or cement bearing materials. In the case of ordinary iron or steel, pitting and penetration results; in the cast of cast-iron the resistant graphitic structure remains, while the pure iron is dissolved out (under wet soil conditions) by


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## "The Great Purifier"

AT the turn of the century, when Chlorine was first introduced as a water purifying agent, there ensued a widely publicized lawsuit to prevent its use. Curiously enough, instead of preventing the use of liquid chlorine, the facts of the case so clearly demonstrated Chlorine's value for water purification that all doubt was forever allayed in the public mind.

Today, over 75% of the drinking water of North America is chlorinated and the typhoid rate stands at the lowest in history. "The great purifier" has done its job well. Its merits require no further selling.

But the test of a service is its availability in times of emergency. Solvay's new "Big 3" Liquid Chlorine Service is designed to fulfill that test. Modern plants, the latest production equipment, a well equipped Technical Service Division assure State and Municipal authorities of quick and adequate supplies of Solvay's Liquid Chlorine and good advice and technical assistance when it is required.

Solvay Liquid Chlorine shipments are now routed from Syracuse, New York; Hopewell, Virginia; and Baton Rouge, Louisiana. Your inquiries on Solvay Liquid Chlorine are cordially solicited. Please write to the nearest branch office listed below.

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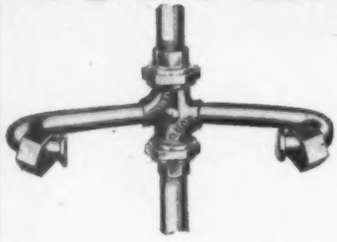
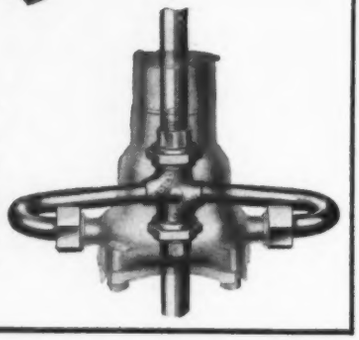
# The FORD COPPERHORN



The COPPERHORN is the perfect fitting for basement water meter installations.



Provides proper meter position, low pressure loss, permanent physical support and electrical bonding of customer's piping. Write for catalog.

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the acids produced as the result of a combination of sulphate break-down and sulfurous or sulphuric acid production. The pipe becomes brittle as a result, but does not leak or disintegrate. Mr. Moore's illustrated presentation of the graphitization phenomena is recommended to all who may be concerned with soil corrosion problems or pipe lines through marshy areas. For a copy, address American Cast Iron Pipe Co., Birmingham, Ala.

**"ARMCO Plate Linings"**—Is a 16 page bulletin from the American Rolling Mill Company, which describes ARMCO Structural Steel Plate Linings, with numerous photographs of their application in tunnel, shaft, caisson work and in sewer lining. The brochure also presents helpful design information for engineers, and adaptation information for contractors. It is stated that the corrugated shape allows reduction in thickness of steel, these plates being 890 per cent stronger than flat plates of like thickness. Plates are available in heavy galvanized finish, or with asbestos bonded protective bituminous coating for the most severe conditions. Pictures of the use of galvanized Armco plates in the Detroit Sewer Tunnel project are especially interesting; others show pipe line tunnels and arch sewers. Details of plate structure and their assembling are clearly illustrated. For a copy of the new ARMCO Bulletin 238, write the American Rolling Mill Company, Middletown, Ohio.

**"DORRCO Aerators"**—Is another new bulletin from The Dorr Company. It is devoted to a description of the Dorrco Paddle Aerator, which is a combination mechanical-and-diffused-air aerator, productive of economy in air consumption and operating costs. The second is the strictly mechanical Dorrco Turbo Aerator offered for the smaller activated sludge plants. Tabulated plant operating data for both type aerators, the listing and picturization of prominent installations supplement the descriptive. There is an appendix of "Useful Information" which includes convenient graphs and charts for calculating power requirements of air blowers, and pressure losses through air mains. For a copy of Bul. 6571 write The Dorr Company, 570 Lexington Avenue, New York City, or any branch office, here or abroad.

**"The Case of the Drifting Particle"**—Is a worthy analysis and discussion in a recent issue of Darco Corporation's monthly, *"Darco News."* It describes a study and presents conclusions indicative that users of powdered activated carbon may gain from a study of the value of increased contact periods between the water treated and the "drifting particle" of carbon. Lack of adequate contact time is shown to be costly in most instances. The indications are, that in many cases not more than 50 per cent of the full capacity of the carbon is realized in plant practice. It reveals the practical application of "Contact Time Curves" (explained) in deciding the proper carbon to use and most effective points of application. Probably, it all explains why some operators prefer carbon blankets on filters to secure maximum use of carbon capacity, others finding basin treatment satisfactory, while some hold that split treatment is overall best. In the analysis there's food for thought and room for monetary savings in taste and odor control. For a copy of *"Darco News"* (July, 1938) write Darco Corp., 60 East 42nd Street, New York, N. Y.

**"Summer Complaints"** is the theme of an interesting little booklet from Wallace and Tiernan Co., which asks "Does *Your* Plant Suffer from Summer Complaints?" Then follows, in order, six "complaints" from which sewers and treatment works suffer when the temperature mounts and septic action brings on the "headaches." These complaints are No. 1, Odors; No. 2, Masonry Attack; No. 3, Overload; No. 4, Deficient Dilution; No. 5, Bulking Sludge; No. 6, Increased Need for Disinfection. Under each is set forth "Symptoms"; "Diagnosis," and "Indicated Treatment." It might have added—"If the symptoms are acute, wire for the W. & T. Doctor. A hypodermic of chlorine can give relief in surprising fashion." If you haven't seen this "First Aid in Summer Complaints" booklet, Wallace and Tiernan Co., Inc., Newark, N. J., will send you one.

**"Liquid Chlorine"**—About two years ago, Pennsylvania Salt Co. issued a comprehensive brochure dealing with liquid chlorine. It became reputed to be the most complete publication of its kind; came into wide demand, the supply was exhausted. Now, Pennsylvania Salt has issued a revised (second) edition of "Liquid Chlorine" presenting up to date information pertaining to chlorine and its compounds, and applications of both in water, sewage, swimming pools, and industrial processes. Graphically presented are temperature-density-pressure-solubility relationships of liquid and gaseous chlorine. Chlorine containers, cylinders, valves, proper and safe piping, valving and connections, are illustrated and described. "Do's and Don'ts," important to the safety of chlorine users, constitute a valuable contribution. Uses of chlorine, the economics of application, and methods and approved equipment for producing hypochlorite are discussed. Analytical methods and testing procedures are presented; methods of locating leaks and handling leaking containers are recommended. Care and use of gas-masks, and what to do in case of accidents, constitutes the closing chapter of 32 pages of hand-book information. For a copy of "Liquid Chlorine" —1938—write Pennsylvania Salt Mfg. Company, Technical Service Department, 1000 Widener Bldg., Philadelphia, Pa.

**"Boiler Meters"**—Is a 32 page bulletin from Bailey Meter Co. of Cleveland, Ohio, which, in addition to describing Bailey Boiler Meters, discusses, amongst other matters, "Five Ways to Reduce Boiler Operating Costs" and, in worthy fashion, also the "Limiting Factors in Reducing Excess Air." Graphically, it presents the average percentage of excess air which various classifications of boiler units are operating with in actual practice. It shows the percentage occurrence of the limiting factors in reducing excess air for combustion boilers, with various methods of firing and types of furnace wall construction. This new bulletin contains much of importance and value to engineers and plant managers operating steam boilers. For a copy of Bulletin 46 write Bailey Meter Company, 1050 Ivanhoe Road, Cleveland, Ohio.

**"Modern Refuse Incineration"**—Comes from Pittsburgh-DesMoines Steel Company—"builders of public utilities for more than 40 years." It presents the subject of refuse and garbage incineration and emphasizes the special features of Pittsburgh incinerators of various designs. Typical plans and elevations of incineration plants are illustrated, and plants in various cities are pictured. In all 70 Pittsburgh plants, with capacities from 6 to 600 tons per day, are listed. For a copy of "Modern Refuse Incineration," write Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, Pa.


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1. Fast floc formation in cold waters
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# That April Convention and Data Edition of WATER WORKS & SEWERAGE

**is now on the desk of many hundreds of Water Works Superintendents, Sewage Superintendents, Engineers and Municipal Officials. It serves as a ready reference manual that is of the utmost value in solving the varied problems that are constantly arising in the operation and maintenance of Water Works and Sewage Treatment Plants. Its usefulness is such that it most appropriately has been called the "BIBLE" by men engaged in the Water Works and Sewerage fields. Plans are now being made for the 1939 Edition, which will incorporate many changes and a complete revision of its text.**

**The Publishers**

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**CONFIRM** by your own jar tests that your filter runs can be longer if you coagulate with the aid of P.Q. Silicate. You will notice the following advantages:

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3. More rapid settling
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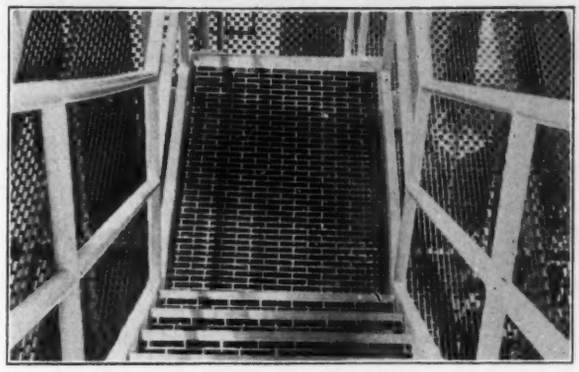

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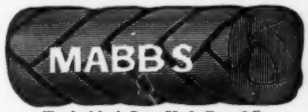


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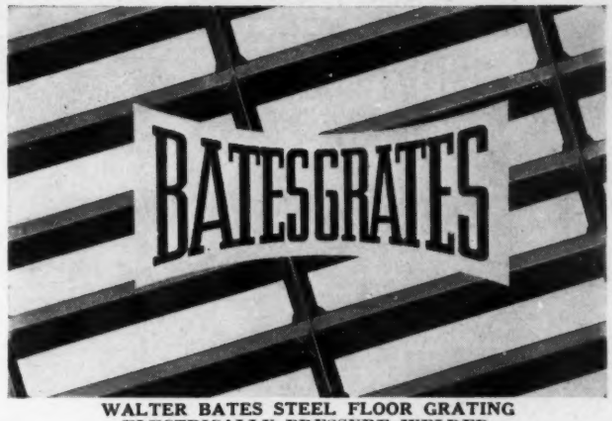


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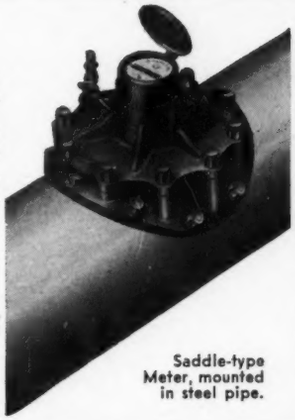

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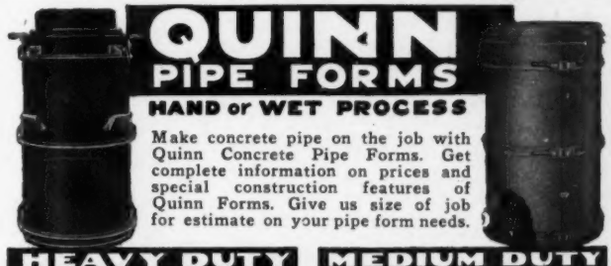

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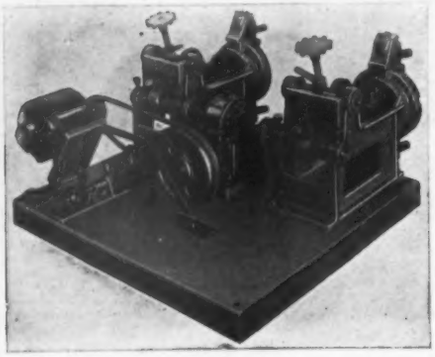

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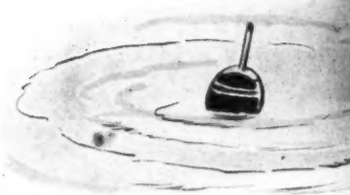

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